GOVERNMENT OF MYSORE.

PUBLIC WORKS DEPARTMENT.

MYSORE-MADRAS ARBITRATION.

ENQUIRY INTO THE QUESTION OF STORAGE OF THE CAUVERY WATERS WITHIN MYSORE TERRITORY.

VOL. I.

RECORDED PROCEEDINGS, EXAMINATION OF EVIDENCE BY THE ASSESSOR AND AWARD OF THE ARBITRATOR.

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Arbitration Proceedings on the dispute between the Madras and Mysore Governments regarding the respective rights of the two Governments as to the waters of the River Cauvery.

Ootacamund, Wednesday, 16th July 1913.

The proceedings began in the Council Chamber at Stonehouse, Ootacamund, at 11 A.M. on the 16th July 1913.

PRESENT.

SIR H. D. GRIFFIN, Judge, High Court, Allahabad—*Arbitrator.*
COL. W. M. ELLIS, R.E., Superintending Engineer, appears as the *Representative of the Madras Government.*

As neither the Mysore Representative nor Mr. Nethersole (who has been unavoidably detained) is present, the proceedings are adjourned to to-morrow.

H. D. GRIFFIN,
Arbitrator.

16*th July* 1913.

Ootacamund, Thursday, 17th July 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ., Inspector-General of Irrigation—*Assessor.*
COL. ELLIS, R.E.—*Representative of the Madras Government.*

A telegram was received yesterday from the Dewan of Mysore to the effect that their Representative will arrive in Ootacamund on the 19th.

Exhibit Ma. 1. The Madras Representative puts in a statement of the case for the Madras Government.

To save time the statement is read and explained by Col. Ellis.

H. D. GRIFFIN,
Arbitrator.

17*th July* 1913.

Ootacamund, Friday, 18th July 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. ELLIS, R.E.—*Representative of the Madras Government.*

Exhibit Ma. 1—a. Accompaniment to paragraph III (2) of Exhibit Ma. 1 read.

H. D. GRIFFIN,
Arbitrator.

18*th July* 1913.

Ootacamund, Saturday, 19th July 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. ELLIS, R.E.—*Representative of the Madras Government.*

The Mysore Representative is not yet in attendance. We were given to understand that he would be present to-day. We regret the delay owing to his absence.

Proceedings adjourned to 21st July.

H. D. GRIFFIN,
Arbitrator.

19th July 1913.

Ootacamund, Monday, 21st July 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Col. Ellis puts in a protest against the letter of the 17th July 1913, from the Dewan of Mysore to the Arbitrator.

After discussion, the *Arbitrator* decided that both parties must stand on the same footing and that, in the case of any important admissions or statements to be made by the Representatives of the Governments concerned, the Representatives are entitled to take the authority of their Government in the first instance.

Col. Ellis wishes to have his protest recorded against its being left to the decision of the Arbitrator whether any statement made binds his Government or not. The position is this. Either Representative may make a statement orally. If recorded by the Arbitrator and signed by the Representative, such statement will bind his Government. The responsibility of signing the statement will rest with him. I do not consider it necessary that all statements on unimportant matters should be reduced to writing and signed by the Representatives making them. Whether a statement is important or not can easily be decided when the question arises, and any statement which the other side claims to have recorded will be so recorded either over the signature of the Representative making it if he takes the responsibility of doing so, or after reference to his Government.

Both Representatives wish to have it recorded that no oral statements made by either party will be binding on either party.

Col. Ellis puts in a brief statement of the Madras case. He asks that before putting in a detailed statement he should see the statement of the case put forward by Mysore. A copy of the statement before the Arbitrator is placed on record. A copy of the statement will be handed to the Mysore Representative.

The Mysore Representative, after perusing the statement made by the Madras Representative, puts in the Mysore statement of the case.

Exhibits My. 1 and My. 1—a.

It is understood that both parties will have the right of rejoinder.

Col. Ellis reads the brief statement of the Madras case.

Statement of the Mysore case read.

Col. Ellis hands in a statement of the information which he asks to be supplied by the Mysore Government.

Proceedings adjourned to 22nd July 1913.

H. D. GRIFFIN,
Arbitrator.

21*st July* 1913.

Ootacamund, Tuesday, 22nd July 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

After discussion the Mysore Representative states that he will communicate with his Government with the object of supplying the Madras Government with a set of rules for regulation of the supply of water from the larger reservoir.

H. D. GRIFFIN,
Arbitrator.

22*nd July* 1913.

Ootacamund, Saturday, 26th July 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

The proceedings were adjourned from the 22nd July until to-day to allow of the Representative of the Mysore Government communicating with his Government as to the rules for the larger reservoir.

Exhibit My. 2. The Representative of the Mysore Government now hands in rules proposed for the working of the larger reservoir.

Exhibit Ma. 1—f. The triennial reports for the years ending 1901-1902 and 1904-1905, asked for by Mysore, are handed in by Col. Ellis. Proceedings adjourned to Monday, July 28th.

H. D. GRIFFIN,
Arbitrator.

26*th July* 1913.

NOTE.—The Committee did not meet on the 28th July 1913.

Ootacamund, Tuesday, 29th July 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Exhibit Ma. 2. Col. Ellis puts in a copy of the Agreement with a note pointing out certain differences between the Madras and the Mysore versions.

Exhibit Ma. 3. Col. Ellis puts in "Reply of the Madras Government to the statement of the Mysore Case."

"Reply" read.

Exhibit Ma. 3—b. Col. Ellis states that his Government will object to the settlement of issues now, if it is the intention of the Mysore Government to put in a further statement by way of rejoinder.

The Mysore Representative is not in a position to state whether a rejoinder will be put in or not.

The proceedings are adjourned to the 4th August.

The next meeting will be held at Bangalore.

H. D. GRIFFIN,
Arbitrator.

29*th July* 1913.

Bangalore, Monday, 4th August 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Exhibit My. 4. The Representative of the Mysore Government puts in a "Rejoinder to the Reply presented by the Madras Government."

Rejoinder read.

With reference to the concluding paragraph of the Rejoinder "if, in this view, it be found necessary to modify the Agreement of 1892, the Arbitration Committee should not, it is submitted, hesitate to suggest and recommend the necessary modifications in that document", I have been requested to place on record my opinion whether it is within the scope of my authority as Arbitrator to record a finding or opinion on the matter. As at present advised, I am of opinion that it is not within the scope of my authority. We shall have to interpret the document as it stands, with the help of such evidence as may be produced which may throw light on the meaning which the framers of the document intended to embody in it. It may be that, in recording my opinion as to the correct interpretation of the document, I may have to express an opinion as to the merits of the Agreement. The amendment of the Agreement is a matter for the two Governments. Its interpretation is the matter with which I am primarily concerned.

Proceedings adjourned to to-morrow.

H. D. GRIFFIN,
Arbitrator.

4th August 1913.

Bangalore, Tuesday, 5th August 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Terms of reference discussed.

H. D. GRIFFIN,
Arbitrator.

5th August 1913.

Bangalore, Wednesday, 6th August 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
Mr. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

In answer to the Representative of the Madras Government the Representative of the Mysore Government states, with reference to paragraph 14 of the Mysore "Rejoinder," that, owing to the imperfect way in which the gauge posts were fixed and for want of down-stream readings, the results arrived at are over-estimated, also the site itself is not suited for measuring high flood discharges.

The Representative of the Madras Government puts in a further statement in answer to the Mysore Rejoinder.

Exhibit Ma. 4.

Statement read.

Draft terms of reference as prepared by the Arbitrator and Assessor handed to the parties.

Proceedings adjourned.

H. D. GRIFFIN,
Arbitrator.

6*th August* 1913.

Draft Terms of Reference.

(1) What is the true interpretation of the Agreement of 1892 ?

(2) (*a*) What is the extent of the prescriptive rights of Madras against Mysore under that interpretation ?

(*b*) What volume of water measured at the Upper Anicut is necessary to conserve these rights unimpaired ?

(3) What portion of this volume may reasonably be assumed to be due to that portion of the whole catchment area which would be intercepted by the Kannambadi Dam ?

(4) Will the construction and working of the Kannanbadi Dam necessarily prevent the passing on to Madras of the quantity of water due to Madras from this catchment area ?

(5) If not, on what principles can rules for regulation of the discharges be best framed which will ensure to Madras full protection of their prescriptive rights ?

H. D. GRIFFIN,
Arbitrator.

6*th August* 1913.

Bangalore, Thursday, 7th August 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Terms of reference discussed.

As to the suggested terms of reference "Will the construction and working of the Kannambadi Reservoir necessarily prevent the passing on to Madras of the quantity of water due to Madras," it is understood that the term of reference set out above will include a full examination of the project from its engineering aspects including controlling agency and other matters relevant to the working of the project.

Item No. 3 of the draft terms of reference is struck out.

The parties are called on to furnish computations which may enable the Arbitrator and Assessor to form an opinion on the following point :—

"What proportion of the volume of water measured at the Upper Anicut may reasonably be assumed to be due to that portion of the whole catchment area which would be intercepted by the Kannambadi Reservoir ?"

Such information, if based on reliable data such as are usually employed in estimating the yield from catchments, may be useful for the decision of the case.

It is agreed that, during the period of adjournment, requisitions for further information made by either party should be sent in the first instance to the Assessor, who, if satisfied that the requisition is reasonable, will forward it for compliance to the other party.

It has been arranged that the Assessor, accompanied by the Representatives of the two Governments, will inspect the site of the proposed reservoir and gauges at various points during the adjournment.

After discussion, the following terms of reference are settled :—

"(1) What is the true interpretation of the Agreement of 1892 ?

"(2) (*a*) What is the extent of the prescriptive rights of Madras against Mysore under that interpretation ?

(*b*) What volume of water measured at the Upper Anicut is necessary to conserve these rights unimpaired ?

"(3) (*a*) What principles and rules for regulation of the discharges in connection with the Kannambadi Reservoir can best be formulated which will ensure to Madras full protection of their prescriptive rights ?

(*b*) Whether the rules at first formulated should not be tentative, and if so, for what period and to what extent ?

"(4) Will the construction and working of the Kannambadi Reservoir necessarily prevent the passing on to Madras of the quantity of water due to Madras ?"

The proceedings are adjourned by consent of parties to the 20th October.

H. D. GRIFFIN,
Arbitrator.

7th August 1913.

Bangalore, Monday, 20th October 1913.

The proceedings were resumed after adjournment on the forenoon of 20th October.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Statement of areas irrigated in Madras under the Cauvery and its distributaries for quinquennial periods from 1890 handed over to the Mysore Representative.

The proceedings are adjourned to to-morrow.

H. D. GRIFFIN,
Arbitrator.

20th October 1913.

Bangalore, Tuesday, 21st October 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.— *Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

The Representative of the Madras Government proposes to put in the evidence and arguments on behalf of his Government on issues I, II and III, and suggests that the Mysore Government will then put in its evidence. The Representative of the Mysore Government has no objection to this procedure being adopted.

The Representative of the Madras Government puts in a "Protest" (Exhibit Ma. 6) regarding information required of Mysore.

The protest is read.

The Mysore Representative wishes for time to consider the protest.

The Madras case, Part I—Legal Arguments, read.

Adjourned to to-morrow.

H. D. GRIFFIN,
Arbitrator.

21st October 1913.

Bangalore, Wednesday, 22nd October 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Read Part II of the Madras case (Historical and Descriptive) to paragraph 39. Madras G. O. No. 296 I., of 18th September 1911 [Ma. 8-(*a*)] put in.

H. D. GRIFFIN,
Arbitrator.

22*nd October* 1913.

Bangalore, Thursday, 23rd October 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Read the Madras case, Part II (Exhibit Ma. 8), "Historical and Descriptive," from paragraph 39 to end.

Appendices examined.

Read Part III (Exhibit Ma. 9), "Engineering Arguments," second issue, paragraphs, 1 to 26.

H. D. GRIFFIN,
Arbitrator.

23*rd October* 1913.

Bangalore, Friday, 24th October 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Read Madras case, Part III, "Engineering Arguments," second issue (Exhibit Ma. 9), paragraphs 27 to end.

Read Madras Part IV (Ma. 10), "Engineering Arguments," third issue, paragraphs 1 to 55.

H. D. GRIFFIN,
Arbitrator.

24*th October* 1913.

Bangalore, Saturday, 25th October 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

The Representative of the Madras Government asks for certain information relating to the area under direct irrigation from the Cauvery and its tributaries from 1890 to 1910.

The Representative of the Mysore Government states that this information will be supplied.

Read Madras case, Part IV, " Engineering Arguments," third issue, from paragraph 55 to end.

At the request of the Representative of Mysore, the proceedings are adjourned to November 6th.

H. D. GRIFFIN,
Arbitrator.

25*th October* 1913.

Bangalore, Thursday, 6th November 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

The Assessor puts in a note (Exhibit Ma. 6-*c*) in reply to Exhibit Ma. 6 (Protest by Madras regarding information required of Mysore).

Statement of the Mysore case with special reference to the Madras case presented on 21st October 1913 read.

Exhibit My 6.

H. D. GRIFFIN,
Arbitrator.

6*th November* 1913.

Bangalore, Friday, 7th November 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Exhibit My 7. Read Part II of the Mysore case (Prescriptive rights).

H. D. GRIFFIN,
Arbitrator.

7*th November* 1913.

Bangalore, Saturday, 8th November 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

The Assessor puts in a note on the method of computing yield from Kannambadi catchments. It is placed on the record.

Exhibit My 8. Read the Mysore case, Part III (Place and mode of measurement).

The proceedings are adjourned to November 24th.

The next meeting will be held at Mysore.

H. D. GRIFFIN,
Arbitrator.

8*th November* 1913.

Mysore, Tuesday, 25th November 1913.

PRESENT.

M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E., Superintending Engineer, Madras.
MR. MORGAN, Madras.
MR. KARPUR SHRINIVASRAV—Chief Engineer, Mysore.
MR. SUBBA RAO, Superintending Engineer, Mysore.

Col. Ellis, under instructions from the Madras Government, states that, if Mysore can guarantee that they will commence to deal with it at once and so save time, he is authorised to hand them unofficially the Madras Rejoinder, Parts V, VI and VII, in anticipation of the formal reading, but otherwise he is to withhold it until the formal reading.

As there are certain technical matters regarding the Kannambadi run-off and the Madras Revenue Report figures of supplies, to be discussed in committee and as their presence is necessary at the discussion, the Mysore Representative states that they are unable to give this guarantee, and the Madras Rejoinder is therefore withheld until the formal reading, and I now proceed to consider in committee with both representatives the technical points alluded to.

M. NETHERSOLE,
Assessor.

26th November 1913.

Mysore, Thursday, 27th November 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Owing to my absence from indisposition, we could not meet on the 24th November as arranged.

Notes, A-3, A-3 (*a*), A-4, A-4 (*a*), and A-4 (*b*) put in.

Ma. 11, Madras Rejoinder, Part V, Legal Arguments, read.

Ma. 12, Madras Rejoinder, Part VI (Facts and Engineering Arguments—second issue), paragraphs 1 to 46, read.

H. D. GRIFFIN,
Arbitrator.

27th November 1913.

Mysore, Friday, 28th November 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Ma. 12. Read Madras Rejoinder, Part VI (Facts and Engineering Arguments—second issue), paragraphs 47 to end.

Ma. 13. Read Madras Rejoinder, Part VII (Facts and Engineering Arguments, third issue), paragraphs 1 to 20.

H. D. GRIFFIN,
Arbitrator.

28th November 1913.

Mysore, Saturday, 29th November 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Ma. 13. Read Madras Rejoinder, Part VII (Facts and Engineering Arguments—third issue), paragraphs 21 to end.

The proceedings are adjourned to December 15th at Madras.

H. D. GRIFFIN,
Arbitrator.

29th November 1913.

Madras, Tuesday, 16th December 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

A-6. Note by the Assessor, dated 3rd December 1913, brought upon the record.

A-6 (*a*). Note by the Madras Representative in reply to the above, put in and brought upon the record.

Mysore Reply (My. 9) to the Madras Rejoinder presented on the 27th November 1913, paragraphs 1 to 88, read.

H. D. GRIFFIN,
Arbitrator.

16*th December* 1913.

Madras, Wednesday, 17th December 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

A-7 Extract from Madras records examined by the Assessor put in and brought on record.

Mysore Reply to the Madras Rejoinder presented on the 27th November 1913, paragraphs 89 to end, read.

The proceedings are adjourned to the 5th January 1914 at Madras.

H. D. GRIFFIN,
Arbitrator.

17*th December* 1913.

Madras, Tuesday, 6th January 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

The Arbitrator places on record the letter and memorial which he has received from the Hon'ble Mr. V. K. Ramanujachariar of Kumbakonam protesting against the construction of the reservoir at Kannambadi. Colonel Ellis states on behalf of his Government that it is left to the discretion of the Arbitrator to decide whether it is necessary or desirable to hear any further representations from persons interested in the matter.

Mr. Karpur Shrinivasrav on behalf of his Government states that, if such representations are to be heard by the Arbitrator, a similar opportunity should be allowed to inhabitants of Mysore interested in the construction of the reservoir.

Colonel Ellis produces copy of a letter received from the Governor of the French Settlements in India relating to the construction of the proposed reservoir. Ordered that the translation of the letter with the accompanying memorandum be copied into the proceedings.

Letter—From the Governor of the French Settlements in India.
To—His Excellency the Governor of the Presidency of Madras.
Dated—Pondicherry, the 10th December 1913.
No.—31.

I have the honour to invite your attention to the new situation which will be created for the French colony of Karikal by the dam which the Government of Mysore propose to erect in the upper reaches of the Cauvery.

It is true that the French lands which are irrigated by this river and the channels taking off from it, represent only a small portion of the tracts whose interests might be affected by this new dam. Nevertheless the irrigation systems of the Karikal colony have already undergone very important modifications owing to the establishment by your Government of irrigation works on the rivers which water it and the arrangements which regulate in each one of these works the distribution of water.

It has therefore seemed to me worth while to make you aware of my keenly-felt desire that the ryots of Karikal who have had already to suffer from shortness of water in the various distributaries effected by your irrigation service, should receive the assurance that the Government of Mysore's project will not aggravate the difficulties which they at present feel in the normal irrigation of their lands.

Memorandum by the Madras Representative, dated 6th January 1914.

With reference to what has been said in the original statement of the Madras case regarding the claims of lands lying within the French Settlements, I am desired to lay before the Arbitrator a copy of a letter which has been received recently from the Governor of the French Settlements in India. The Government of Madras are informing His Excellency that the question of the construction of the Mysore reservoir forms the subject of arbitration proceedings which are now pending, and that the requirements of the French lands irrigated by the Cauvery have been included in the statement of the amount of water which has been put forward by the Government of Madras.

Discussion as to paragraph 99, Part VI, Madras case, and paragraph 78, Mysore case, Part II, and paragraph 88, Mysore Reply to Madras Rejoinder:—

The Mysore Representative states that he wishes to retain in paragraph 88 the words "average estimated" so that Mysore should have the benefit of any exceptional floods during the hot season.

The Madras Representative contends that the Mysore Government have already admitted in paragraph 78 that at the most the Madras claim is only to the *natural flow*.

Ma. 14. Read Madras Rejoinder to Mysore Reply, My. 9, paragraphs 1 to 89.

Received and recorded representations from inhabitants of the Tanjore district, relating to the matter under arbitration.

H. D. GRIFFIN,
Arbitrator.

6th January 1914.

Madras, Wednesday, 7th January 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Colonel Ellis puts in a statement relating to second and perennial crops requiring irrigation above the Upper Anicut.

Ma. 15.

Ma. 16. Colonel Ellis puts in further extracts from records as addenda to A-7.

Adjourned to 20th January 1914 at Madras.

H. D. GRIFFIN,
Arbitrator.

7th January 1914.

Madras, Thursday, 8th January 1914.

PRESENT.

M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Read Colonel Ellis' note on comparative cross sections of the Cauvery river in the neighbourhood of the dam; and note recorded as Ma. 17.

References as to the missing sections of 1899 will be filled in. The file regarding this was examined.

Cross sections also examined and the following information called for by the Assessor:—

Comparative mean bed levels for 1867 and 1909 at the Cauvery Dam at 150 yards calingulah and at Bhavani Bridge.

Comparative mean bed levels, 1902 and 1906, at 1,000 feet above the Cauvery Dam and at 1,000 feet, 2,000 feet, and 3,000 feet below the Cauvery Dam.

Colonel Ellis puts in figures of areas of second and perennial crops under channels fed by the Cauvery between Bhavani and Upper Anicut for years 1890, 1895 and 1900, filed as Ma. 15-*a*.

M. NETHERSOLE,
Assessor.

8th January 1914.

Madras, Tuesday, 20th January 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

With reference to the representations received from the inhabitants of the Tanjore district protesting against the construction of the Kannambadi Reservoir

(*vide* Proceedings of the 6th January 1914), I have decided to simply acknowledge their receipt.

Mr. Nethersole and I paid a visit of inspection to the Lower Anicut on the 17th January 1914.

My. 12. — Read Mysore Reply to the Madras second Rejoinder (of 6th January 1914).

Ma. 18, Ma. 18 (a), 18 (b), 18 (c). — Colonel Ellis puts in a note and diagrams with statements on the Cauvery channels above the Upper Anicut. The note is read.

Ma. 19. — Colonel Ellis puts in a further note supplementing Appendix XXII, Ma. 14.

Ma. 20. — Colonel Ellis puts in a note on Revenue remissions in the delta-irrigated area, Tanjore district.

Ma. 17 (b). — With reference to the proceedings of the 8th January 1914, Colonel Ellis puts in a note on the level of river bed at the Cauvery Dam.

H. D. GRIFFIN,
Arbitrator.

20*th January* 1914.

Madras, Wednesday, 21st January 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Colonel Ellis presses for a definition of what is exactly meant by the expression "average estimated natural flow" in paragraph 16 of My. 12.

Mr. Shrinivasrav states he will send a note on the matter after consultation with his Government.

Mr. Shrinivasrav states that after consultation with his Government he will put in, if necessary, notes on the documents put in by Colonel Ellis on January 20th.

In order that the proceedings may not be delayed, Mr. Shrinivasrav states he will send the notes direct to me and copies to Colonel Ellis at the same time.

The proceedings are adjourned to the 3rd February 1914 at Madras.

H. D. GRIFFIN,
Arbitrator.

21*st January* 1914.

Madras, Tuesday, 3rd February 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Read the following notes put in by the Mysore Representative—

My. 13 with statement My. 13-*a* — (1) Note on the average estimated natural flow at Sivasamudram during the hot weather.

My. 14. — (2) Note on the remissions and loss of crops in the Cauvery Delta.

The Assessor however (paragraph 179) says "I think there can be no dispute on the basis of the 1892 Agreement as to the right of Madras to claim a fixed limit gauge throughout the irrigation season, June to January, if they wish to adhere to that claim."

I would ask if this opinion is accepted by the Arbitrator and the reason is of the nature of an additional reason or if it is of a nature rejecting Mr. Nethersole's conclusion and substituting in its place a different reason for a fixed gauge.

(*b*) I would like explanation with regard to the Assessor's Examination of Evidence with reference to paragraph 181. I am not clear if this paragraph is to be intended merely as a statement of what are Madras' claims or of the Assessor's opinion from the words "it is in the nature of an essential principle . . . . shall be such as to conserve those rights unimpaired."

I believe this to be intended to convey the Assessor's opinion and would ask if this is so and if this is accepted by the Arbitrator under the general clause accepting the Assessor's views where the matter is not separately dealt with.

W. M. ELLIS, COL., R.E.,
Madras Representative.

24th February 1914.

Record of Proceedings before the Assessor, dated the 24th February 1914.

Discussed the note by Mysore on rules for working the reservoir and explanatory tables put in by Mysore with their letter No. C. 105 of 17th February 1914, and Colonel Ellis' remarks thereon.

The following replies to Colonel Ellis' queries are recorded:—

(1) (*a*) The nearest classification to be taken.

(1) (*b*) Classification is altered to suit actuals at the end of October.

(2) For working tables 1,000 should be taken.

(3) Yes.

(5) Yes, but additional period will be added to make up for any delay after 1st July only.

Corresponding crop increase to make up to 156 millions cubic feet normal daily draw-off, will be made in the monsoon crop.

(6) This is to be checked by the Representatives together. The Mysore formula suggested is $\frac{5}{4}$ (1,000—S.D.), S.D. being Sivasamudram discharges.

(7) The normal daily draw-off during this period is 156 millions cubic feet; but when the reservoir is surplusing, the intention is to draw off up to a limit of 260 millions cubic feet per day; the total extra quantity so drawn off in any one year being limited to 4,000 millions cubic feet, the 4,000 millions cubic feet now quoted being subject to formal approval by the Mysore Government.

(8) The limits which I suggest for evaporation calculations are as follows:—

	INCHES.
June	5
July	4
August	4
September	4
October	4
November	4
December	4
January	4
February	4
March	5
April	7
May	8
Total ...	57

The question as to how evaporation is to be dealt with was decided as follows after discussion—

It appears that the Mysore figures of 107 millions cubic feet daily draw-off for the monsoon and 49 millions cubic feet perennial crop included allowance for evaporation and, if this allowance be eliminated, it will reduce those figures to—

103 for monsoon, and

44 for perennial.

The working tables should be amended accordingly and evaporation allowed for on the scale which I have fixed above on the actual waterspread at the beginning of each half month.

M. NETHERSOLE,

24th February 1914. *Assessor.*

Madras, Thursday, 26th February 1914.

PRESENT.

M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Assessor's explanation called for by the Madras Representative on 24th February 1914 on paragraph 97 put in as directed as an addendum to the Assessor's Examination of Evidence on issue 2 (*b*).

2. Both Representatives agree as to the ratio of the Kabbini discharges at Sivasamudram for days on which the Sivasamudram discharge is not available for months of January to first half of June being taken as 1·5 of the Kannambadi discharge.

3. Both Representatives accept the assumption, whenever the Kannambadi recorded discharge is *nil*, of a minimum discharge of 5 millions cubic feet per day as the Kabbini discharge.

4. Read note My. 19 put in by the Mysore Representative, the object of which is to show that there is reasonable ground for re-opening the case in so far as it affects the award of 900 cusecs minimum constant supply measured at Sivasamudram for the hot weather period.

Madras represents that this is new matter which should not now be considered and which they are not called upon to reply to unless the Arbitrator considers it necessary to re-open the whole matter.

My opinion as Assessor is that I am not competent to decide whether the case should be re-opened in this connection, as it is, I consider, a matter entirely within the discretion of the Arbitrator to decide and his only.

I may, however, record my opinion that Mysore had ample opportunity to produce the evidence or arguments they now ask should be amended during the Arbitration proceedings.

There was never any doubt as to the Madras acceptance of 900 cusecs as measured at Sivasamudram in lieu of their claims on the supplies during the hot weather period; this was never questioned by Mysore either as to quantity or as to place during the proceedings, and in my opinion it should not now be questioned further.

5. For the purpose of the tentative working tables as already ruled, the project allowance of 1,000 cusecs measured at Sivasamudram should be adopted.

6. For a tentative figure to be adopted for the loss in transmission for evaporation and absorption *en route*, 40 per cent for June and 22·5 for the remainder of the year.

M. NETHERSOLE,

26th February 1914. *Assessor.*

Madras, Wednesday, 18th March 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

The meeting fixed for the 11th instant was postponed at the request of Mysore to the 15th March and was again postponed at the request of Madras to the 18th March.

Assessor puts in explanations asked for by Madras of certain paragraphs in his Examination of the Evidence.

Explanations asked by Madras Representative as regards Assessor's Examination of Evidence and replies given by Assessor.

Reference to Assessor's paragraphs.	Assessor's reply.
Paragraph 16.—If 1895 originally put in the typed copy is not correctly now altered to 1893 ?	1893 is correct.
Paragraph 49.—Am I correct in understanding that the "Cauvery channel" refers to the head of the Cauvery river in the vicinity of the Cauvery Dam ?	Yes.
Paragraph 56.—Am I correct in understanding that "deterioration of the Cauvery due to silt" here referred to refers to silt deposition at the head of the bifurcation of the Cauvery and Coleroon in the vicinity of the Cauvery Dam ?	Yes.
Paragraph 57.—Also that "the channel" in paragraph 57 refers to the Cauvery river bed in the vicinity of the Cauvery Dam ?	Yes.
Paragraphs 51 *and* 57.—Am I correct in understanding this to imply that in the opinion of the Assessor the facts and reasons adduced show that the supplies over the Cauvery Dam which were obtained for a 6½ ft. gauge prior to 1893 were only obtained on a 7-ft. gauge from about 1893 to the remodelling of the Upper Anicut? Further that, as a result of such remodelling and consequent improvements of the Cauvery head, the supplies passed over the Cauvery Dam in 1909 for a 7-ft. gauge were materially greater than those passed for a 7-ft. gauge between 1893 and 1899 and approximated to those obtained with a 7-ft. gauge between 1882 and 1893?	No, the evidence as to facts is by no means conclusive and I have therefore been unable to form a definite opinion as to whether or not there was actual deterioration in the Cauvery channel affecting its supplies. But it is in my opinion perfectly clear from the evidence that Col. Smart and the Chief Engineer thought there was and that it was in this belief that the change in rule of 1896 was proposed and sanctioned and the Upper Anicut remodelled—*vide* paragraph 56.
Paragraph 81.—Is the entry (paragraph 22) not a mistake for paragraph 71 ? This entry was made in this office but not brought to my notice.	Yes. Paragraph 71 is correct.

Reference to Assessor's paragraphs.	Assessor's reply.
Paragraph 185.—*Necessary for their irrigation.*—This is understood to mean was not necessary to run on to the fields for purposes of irrigation. Is this a correct limitation ?	Yes.
Paragraph 164.—(*a*) Am I correct in understanding that the 25 per cent there alluded to *over and above normal supply* does not mean such limit gauge as will give about 25 per cent extra quantity of water for the season over and above the quantity necessary for a steady and reliable supply given day by day but means a limit flow of 25 per cent extra to such steady daily supply only on any day when it may be realised by natural flow ?	Yes. This is the meaning.
(*b*) If this is correct, I would ask what is the authority for the statement that this extra percentage has been admitted by Madras to be suitable, or admitted to have been adopted in the past as the limit flow suitable for Cauvery irrigation supply.	I cannot find any such statement. Please give the reference.

Read My. 19 and My. 19a put in before the Assessor on the 26th February and My. 20 put in to-day.

My. 20 is an application for re-opening the case in so far as the decision on the question of the hot weather supply is concerned.

With reference to paragraph 3 of My. 20 to the effect that no award has yet been pronounced or delivered by the Arbitrator in regard to the hot weather supply though a finding has been recorded, I may state that my finding is recorded in the following words:—

"I find (1) that Madras must be held to have a prescriptive right for the irrigation above the Upper Anicut to a supply necessary for all channels hitherto in use, (2) that the hot weather supply would be considered the supply for the period between February to May inclusive, and (3) that Mysore shall be bound, subject of course to exemption to liability for interruptions beyond their control, to send down during the hot weather season a continuous supply of 900 cusecs to Madras."

By an oversight, I did not add the words "and I award accordingly."

I therefore here record that my award on the question of the hot weather supply is in the words of the finding set out above.

Having considered My. 19 and My. 20, I am of opinion that no cause has been shown for re-opening the case as to the question of the hot weather supply.

With reference to the statement put in to-day by the Madras Representative to the effect that a letter of Col. Smart was not forthcoming when called for by the Assessor but that since the delivering of the award a draft of the letter in Col. Smart's handwriting had been found and asking the instructions of the Arbitrator in the matter, as the letter is not tendered by Madras and as the award has been delivered, it is not necessary to call for its production now.

The award on the hot weather supply is to be taken as an award under the second issue.

The Madras Representative puts in a note on the third issue, as affected by the finding on the second issue (Exhibit Ma. 24).

The note is read.

The Mysore Representative puts in a note on the working tables based on the Mysore system of measurement in connection with the third issue (Exhibit My. 21).

Mysore puts in working tables prepared for two systems referred to as the Mysore system and the proportionate systems (Exhibit My. 21-h, 21-i, 21-j).

Madras puts in working tables (Exhibit Ma. 24a, 24b, 24c, 24d)with enclosures marked 1 to 13 in each set. Madras also puts in abstracts of tables (Exhibit Ma. 24e and 24f); also five diagrams for table g, exhibit Ma. g-1 to 5 and five other diagrams for table h, Exhibit Ma. h-1 to 5.

By agreement between the parties who wish time to consider the statement and working tables put in, the proceedings are adjourned to March 31st at Madras.

H. D. GRIFFIN,
Arbitrator.

18*th March* 1914.

Proceedings before the Assessor, Madras, dated the 19th March 1914.

Ma. 24E and F, tables 10 and 12 based on third system.

The deficiencies entered in column 4 do not take into account the flood replenishments which, as noted in Assessor's Examination, paragraphs 173 and 174, must, under the third system, still be enjoyed. I should like this replenishment shown both for actual full flood gauges and also restricted to the limits of the Madras claims of 2,944 million cubic feet and 2,300 million cubic feet.

Mysore tables.—Please add in column 9 percentages of column 8 on column 7.

In column 16, percentages of compensation water on quantities at Cauvery Dam to limits of 1,966, 2,300 and 2,944 million cubic feet.

M. NETHERSOLE,
Assessor.

19*th March* 1914.

Madras, Tuesday, 31st March 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Certain explanations asked for by Madras to the Arbitrator's findings are placed on record.

Explanations asked as regards Arbitrator's findings.

Reference.—Arbitrator's Award (page 139, lines 31 to 33).

(*a*) No material deterioration in river channels since 1881. Does "river channels" here used refer to the beds of the rivers in the vicinity of the Cauvery Dam?	Yes.
(*b*) Do the lines mean that your finding is that the mean river bed level at the head of the Cauvery in the vicinity of the Cauvery Dam was materially the same in 1910 as in 1881?	
Or.	
Does it mean that the river bed levels have not materially altered at any time throughout the period?	They are an expression of opinion to that effect based on paragraphs 52 to 57 in Assessor's Examination of the Evidence.

Ma. 25	..	....	.... Madras puts in a further statement on the III term of reference with connected abstracts, tables and diagrams, as detailed below.
Ma. 25-A 1 to 13		....	.... Abstracts of Table XII for 13 years, 1896-97 to 1908-09 with limits of flow of 2,944 and 2,300 m.c.ft. and for natural flow at the Cauvery Dam.
Ma. 25-B 1 to 13		....	.... Abstracts of Table X for 13 years, 1896-97 to 1908-09 with limits of flow of 2,944 m.c.ft. and 2,300 m.c.ft. and for natural flow at Cauvery Dam.
Ma. 25-C 1 to 5		....	.... Abstracts of Table III, Mysore System (corrected tables), for five years for limits of flow of 2,944, 2,300 and 1,966 m.c.ft. and for natural flow at Cauvery Dam.
Ma. 25-D	....	....	.... Corrected table III, for factors 1·6 and 3·33 for 13 years, 1896-97 to 1908-09.
Ma. 25-E	....	....	.... Corrected Table III, for factors 1·8 and 4 for 13 years, 1896-97 to 1908-09.
Ma. 25-F 1 to 5		....	.... Mysore Table III (corrected), diagrams showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam for years, 1898, 1902, 1904, 1905 and 1908.
			The statement is read.
My. 22	....	....	... Mysore puts in a further statement on the 3rd term of reference with connected abstract statements H-1, H-2, K, L, M, N and P.
My. 22 1-7	....	....	.... The statement is read.

By consent the discussion as to the rules for the regulation of the discharges in connection with the Kannambadi Reservoir is postponed until the term of reference 3 (*b*) comes up for decision except in so far as a decision on the question of tentative proportion is necessary for the decision of the term of reference 3 (*a*).

The proceedings are adjourned to the 9th April for the Assessor's meeting with the Representatives at Ootacamund.

H. D. GRIFFIN,
Arbitrator.

31*st March* 1914.

Proceedings before the Assessor, dated Madras, the 1st April 1914.

Discussed various points in the statements of differences found by each party in checking tentative working tables for the reservoir prepared by the other party.

The differences are not very great and it is agreed that the tables may be accepted as they stand as materially representing the facts they are designed to illustrate.

My. 22 (*a*) being an explanatory note in continuation of My. 22 put in at the request of the Assessor, recorded.

Discussed and decided that allowance for draw-off for power for 1899 for working tables for days for which actual discharges at Sivasamudram are not available is to be made at the rate of 500 cusecs daily for December.

No allowance necessary for November.

M. NETHERSOLE,
Assessor.

1st April 1914.

Ootacamund, Thursday, 9th April 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Mysore puts in a rejoinder to the Madras note on the third issue and a reply to Madras note, Ma. 25, Working tables, with tables attached My. 24 (*a*), (*b*), (*c*) and (*d*).

My. 23.
My. 24.

My. 23 and My. 24 are read.

Madras puts in a further note on the third issue on the yield of the combined Kannambadi and Kabbini catchments with tables attached.

Ma. 26.
Ma. 26. (*a*)

The note is read.

The proceedings are adjourned to the 11th April 1914.

The Assessor proposes meeting the Representatives to discuss any points considered material by him. It is understood that, if the parties desire to make any further representations on any new aspects of the issue which may be the outcome of the discussion, the parties are restricted to representations bearing directly on such new aspects.

H. D. GRIFFIN,
Arbitrator.

9th April 1914.

Ootacamund, Saturday, 11th April 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Madras puts in a further reply on the third issue.

Ma. 27

The reply is read.

The Assessor brought to notice various points to which he wished to direct the particular attention of the parties.

With reference to the penultimate paragraph of the proceedings of March 31st, by consent, the rules 3 (*a*) term of reference, 3 (*b*) term of reference and the 4th term of reference will be considered together.

The proceedings are adjourned to a date to be fixed later.

H. D. GRIFFIN,
Arbitrator.

11th April 1914.

Ootacamund, Tuesday, 21st April 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

On the 18th April the letter appended to these proceedings was received by me from the Mysore Representative enclosing a telegram from his Government asking that alternative awards on the term of reference under consideration should be given with the option to Mysore to elect any of them.

Apart from the fact that this request was made at such a late stage of the proceedings, the question at issue is not one which, in my opinion, permits of alternative decisions. I must, therefore, decline to entertain this request.

The Assessor read his examination of that part of the term of reference 3 (*a*) under consideration.

The Arbitrator then read his award.

Ma. 28. The Madras Representative puts in a note on the fourth term of reference.

With reference to paragraph 6 of the above note, the Arbitrator having signified his consent to hear a further representation from Madras, the Madras Representative puts in a further note.

Ma. 29.

The proceedings are adjourned to to-morrow.

21*st April* 1914.

H. D. GRIFFIN,
Arbitrator.

ENCLOSURE.

Letter—from Karpur Shrinivasrav, Esq., B.SC., L.C.E., Representative, Mysore Government.
To—Sir H. D. Griffin, Kt., I.C.S., Arbitrator, Mysore-Madras Arbitration, Camp, Ootacamund.
Dated—Camp, Fern Hill, the 18th April 1914.
No.—115.

I have the honor to forward a telegram just received from my Government for favour of consideration in granting the award on the third issue. It is requested that alternative awards may be given with the option to Mysore to elect any one of them.

2. I am sending a copy of this together with a copy of the telegram to the Assessor.

Sub-Enclosure.

Telegram—from the Dewan of Mysore.
To—the Mysore Representative.
Dated—the 18th April 1914.
No.—T-76.

Please represent to Arbitrator by letter to-day that Mysore would urge the desirability of alternative awards on third issue with option of electing one of them.

Ootacamund, Wednesday, 22nd April 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

The Mysore Representative intimates that he wishes to put in a reply to Ma. 29.

The Madras Representative puts in the query appended to proceedings relating to the award delivered yesterday. The Assessor will give a written answer.

Ma. 30. The Madras Representative puts in a note requesting that the record be amended by correcting "the statement that the 4th or the modified Madras system was proposed by Mysore as an alternative in the event of their own system not being adopted." The Mysore representative states that his Government's reply would be ready by the 29th April.

The proceedings are adjourned to to-morrow.

22*nd April* 1914.

H. D. GRIFFIN,
Arbitrator.

ENCLOSURE.

Question on award by the Madras Representative.

(*Note.*—1,330 millions cubic feet per 24 hours=15,394 cubic feet per second.)

Am I correct in understanding the intended application of the award as regards the periods of application of standard table II and the limitations of such application to be as follows :—

I. That the introduction of the application of the table is restricted to times when both the following conditions obtain and this applies both to periods of commencing impounding and the change from table I to table II—

(*a*) That the flow over the Cauvery Dam has not at any time during the preceding four days exceeded 6 feet.

(*b*) The inflow at Kannambadi does not exceed 15,394 cusecs.

II. That, during the period of application of table II, this should cease under either of the following conditions :—

(i) Over 6 feet gauge realised at Cauvery Dam.

(ii) Twelve hours after inflow to Kannambadi exceeds 15,394 cusecs.

W. M. ELLIS, COL., R.E.,
Madras Representative.

22nd *April* 1914.

Proceedings before the Assessor, dated 22nd April 1914.

Discussion as to duties.—Madras agree that the monsoon crop duty advanced by Mysore in My. 25 is reasonable and may be accepted for working tables.

After hearing both parties on the subject of perennial crop duties, I consider that a duty of 60 cusecs for 30,000 acres probable sugar cane; and 80 acres for 10,000 probable orchard and garden crops, are reasonably safe average duties to be adopted.

In the course of the discussion, the Mysore Representative pointed out that if the areas given in the project as now advanced in My. 25 on the duties decided on as reasonable applied to the working tables as modified by the award under the second

and third clauses of the award, shew that they could not always irrigate the full project area every year, it would be open to them to revise the project to irrigate a rather smaller area. The Madras Representative objected to any such alteration in the scope of the project as already presented, which is the subject of the Arbitration. The question of whether the failure or success of the Mysore project is material is one on which the Arbitrator is to give a ruling after receiving the Mysore representation on the subject and I cannot give any decision on this point.

So far as the preparation of working tables is concerned, I consider that the project area and duties as now settled should be adhered to.

A provisional scale for working the reservoir in place of that put in My. 19 (*a*) will be furnished by the Chief Engineer, Mysore, at once in order to allow the working tables to proceed without delay, on the understanding that the scale is not to be considered as binding on Mysore until it has been formally approved by the Mysore Government.

M. NETHERSOLE,
Assessor.

22*nd April* 1914.

Ootacamund, Thursday, 23rd April 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

The Assessor puts in his reply (appended) to the query of the Madras Representative recorded in yesterday's proceedings.

My. 26. — The Mysore Representative puts in a reply to Ma. 30.

Ruling on the point raised in Ma. 30:—

A perusal of the references quoted by both parties on the point raised by Madras in Ma. 30, more especially My. 22, 36-(*b*), shows clearly that the statement in the Award which Madras desire to have modified is correct in substance. The offer of the Mysore Durbar which Madras state they accepted is in fact not the offer made by Mysore which was qualified by fixed proportion factors. Moreover, it is clear that the order in which Mysore placed the system as defined in My. 22 (37) was order of preference.

I am satisfied that the Mysore Durbar never intended that they should be considered as free and equal alternatives as is represented by Madras—*vide* My. 22, 36-(b).

I certainly never understood them to be intended as free and equal alternatives and I am authorised by the Assessor to state that neither did he understand them in that light.

My. 27. — Mysore puts in the provisional scale as referred in proceedings before the Assessor of 22nd April 1914.

The proceedings are adjourned to 29th April 1914.

H. D. GRIFFIN,
Arbitrator.

23*rd April* 1914.

ENCLOSURE.

Question on Award by the Madras Representative and the reply given by the Assessor.

(NOTE.—1,330 millions cubic feet per 24 hours = 15,394 cubic feet per second.]

	Reply by the Assessor.
Am I correct in understanding the intended application of the Award as regards the period of application of standard table II and the limitations of such application to be as follows:—	
I. That the introduction of the application of the table is restricted to times when both the following conditions obtain and this applies both to periods of commencing impounding and the change from table I to table II:—	I. The sole criterion is I (*a*) whether for commencing impounding or for change from table I to table II.
(*a*) That the flow over the Cauvery Dam has not at any time during the preceding four days exceeded 6 feet.	
(*b*) The inflow at Kannambadi does not exceed 15,394 cusecs.	
II. That during the period of application of table II this should cease under either of the following conditions:—	II. During the period of application of table II, the sole criterion of change to table I is in II (ii) after inflow to Kannambadi has exceeded 15,394 cusecs.
(i) Over 6 feet gauge realised at Cauvery Dam.	
(ii) Twelve hours after inflow to Kannambadi exceeds 15,394 cusecs.	
W. M. ELLIS, COL., R.E., *Madras Representative.*	M. NETHERSOLE, *Assessor.*
22nd April 1914.	*23rd April* 1914.

Ootacamund, Wednesday, 29th April 1913.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

The Representative of Mysore puts in My. 28 in reply to Ma. 28 and 29. It is read.

Ma. 32. Madras puts in a further rejoinder to My. 28 of the 26th April 1914.

The Madras Representative states that, when the term of reference No. 4 was framed, he was under the impression that the examination of the Mysore project would include an examination into the prospects of that project, whether it would be a success or failure.

By Arbitrator.

As the Madras Representative was under the impression that the fourth term of reference was intended to include an examination of the Mysore project as to the

prospects of success or failure, the Madras Government cannot be prejudiced by the imperfect wording of the term of reference No. 4 and this question will now be considered.

It is desirable that copies of the following records of gaugings should be placed on the record of these proceedings.

The originals should be produced here and copies made by the opposite parties and verified as correct. They will then be placed upon the record.

"For purposes of settling the gaugings at next meeting the following original gauge registers are required:—

From Mysore.

(1) Sivasamudram, January 1909 to end of 1913 (December).
(2) Alalkatte (Chamraj) Anicut on the Cauvery, from January 1909 to December 1913.
(3) Sriramadevar Anicut on the Hemavati, from January 1909 to December 1913.
(4) Chick Devaroy Sagar and Devaroy Anicuts for 1913.
(5) Hulhalli Anicut on the Kabbini for 1913.
(6) The anicuts on the Lakshmanathirtha on which daily gauge-readings were taken last year for 1913.

From Madras.

(7) Original registers, Cauvery and Upper Anicut, for 1910 to 1914.
(8) Original registers, Bhavani bridge, for 1910 to 1914."

The Madras Representative puts in the query appended relating to the Award on 3 (*a*).

The answer is in the affirmative.

The Madras Representative puts in a note on the Award on 3 (*a*) asking for the revision of the Award on the point (*c*) in the note.

Ma. 33.

The matter will be considered and a decision will be delivered later.

The proceedings are adjourned to May 4th.

H. D. GRIFFIN,
Arbitrator.

29th April 1914.

ENCLOSURE.

Enquiry by Madras Representative with regard to the Award on Issue 3 (*a*).

With regard to the last four lines of the Arbitrator's Award commencing "It is to be understood.....," am I correct in believing that the factors referred to as "tentative" and as requiring further final adjustment include both the proportions of ·625 for south-west monsoon and ·30 for the north-east monsoon and the percentages allowed for loss in transmission, *viz.*—

20 per cent. for south-west monsoon.
17 „ for north-east „

W. M. ELLIS, COL., R.E.,
Madras Representative.

29th April 1914.

Proceedings before the Assessor, dated Ootacamund, Friday, 1st May 1914.

In reference to the point raised in Ma. 34 and My. 29, all dates will refer to Kannambadi and will be for south-west monsoon, 1st June to 30th September, for north-east monsoon, 1st October to 31st January, and hot weather, 1st February to 31st May.

M. NETHERSOLE,
Assessor.

1st May 1914.

Ootacamund, Tuesday, 5th May 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Letter note by Mysore on some points relating to working tables and note by Mysore urging reconsideration of award on hot weather supply, copies of which have been received by Madras, are taken as read.

My. 30.
My. 31.

Proceedings of Assessor of 1st May 1914 confirmed.

The parties produce the gaugings called for at the meeting of the 29th April.

Mysore demi-official No. C. 120 to Assessor of 1st May with Assessor's reply endorsed therein is brought in to-day's proceedings.

Ma. 35.
Ma. 35 (1—13).

The Madras Representative puts in a statement of their case regarding issues 3 (*b*) and 4 with working tables appended.

My. 32 and 33.
My. 33 (1—13).

The Mysore Representative puts in statement in two parts of their case on the same issues with working tables appended.

Assessor's decision on Exhibit Ma. 33, *dated* 30*th April* 1914.—In reference to the point raised in Ma. 33, I consider it is extremely improbable, after impounding has once commenced under either table I or table II, that the impounding under the principles defined in the Award should ever result in a gauge at the Cauvery Dam of only 6·0 feet or less at any time during a period of four days; but if such did occur, impounding would, under the principles defined in the Award, at once either revert to, or continue under, table II. This should be made clear in the rules which have still to be drawn up. There appears to me to be no necessity to alter the wording of the Award.

I agree.

The proceedings are adjourned to May 8th.

H. D. GRIFFIN,
Arbitrator.

5th May 1914.

ENCLOSURE.

Demi-official—from the Mysore Representative.
To—the Assessor, Mysore-Madras Arbitration, Ootacamund.
Dated—Camp, Fern Hill, Ootacamund, the 1st May 1914.
No.—C. 120.

I enclose a sample table showing the application of tables I and II. Agreeably to the ruling given by you to-day in answer to query II, the impounding on the 22nd will naturally be under table I, as shown in the accompanying sample table for reasons given in the foot-note thereof.

I am revising the Mysore working tables accordingly and I request you will kindly give your formal approval to this procedure and intimate to Madras also.

A copy of the ruling is also enclosed* for ready reference.

*Printed with proceedings before the Arbitrator dated 23rd April 1914.

Yes, this is correct. Please send Madras a copy and this will be recorded on Tuesday.

M. NETHERSOLE,
Assessor.

1*st May* 1914.

C. No. 122/E-2, Camp, Fern Hill, Ootacamund, dated 2nd May 1914.

Copy of the above with enclosures is forwarded to the Madras Representative for information.

KARPUR SHRINIVASRAV,
Mysore Representative.

2nd May 1914.

Sub-Enclosure.

SAMPLE TABLE.

June 1896.

Date	Flow at Kannambadi.	Gauge Cauvery dam same day at 6 A.M.	Table to be applied.
	m.c.ft.	ft.	
15th	162	1·9	....
16th	150	2·1	....
17th	626	4·0	....
18th	821	3·8	....
19th	1,971	3·3	II
20th	5,957	3·8	II
21st	9,192	4·1	II
22nd	6,053	7·4	I
23rd	10,452	9·7	I

NOTE.—The gauge at 6 A.M. on the 21st was 4·1 and at 6 A.M. on the 22nd was 7·4. Hence the gauge will have exceeded 6 feet before the 22nd day has commenced at 6 A.M. and therefore table I will be applied on the 22nd.

Ootacamund, Thursday, 7th May 1914.

Mysore put in a further note on the provision made in the project for power supply recorded as My. 34.

Discussion as to rules—as the basis of this discussion it will be convenient to take the draft rules as defined in Ma. 35.

Rules I and II accepted.

Rule III (*a*) accepted with the exception that Mysore wish the interval of adjustment of sluices to be six hours instead of twelve hours whenever the Kannambadi flow has at the previous occasion of adjustment exceeded 1,000 millions cubic feet. Both parties hope that the gauging sites to be selected on the three confluents may be fixed so close to the water-spread of the reservoir as to reduce the necessity for computation from parts of the catchment not discharging above the points of the selection to a minimum. The last clause of (*a*), (*b*), (*c*) and (*d*) Mysore wish to reply to.

IV to VI accepted.

VII accepted with the exception noted under III (*a*).

VIII. In accepting this rule, Mysore wish to change the words "either Government" to "of the Madras Government" as they desire that the controlling officer should be appointed by them.

IX contentious.

X accepted.

4 accepted, see also III (*a*).

5 contentious.

6 Mysore object to this, but await the ruling of the Arbitrator.

2. *Tentative period.*

7 to 24 non-contentious. Mysore make certain additions in their own Exhibit My. 32.

25 to 37 contentious.

40 non-contentious.

41 Mysore agree that the sluices shall be designed with all usual precaution as to prevent tampering and to ensure satisfactory working.

The provision (*b*) for gearing together is probably impracticable.

42 to 48 accepted.

49 accepted generally except as to the proposal that the controlling officer and staff should be independent of both Governments and appointed by the Government of India, Mysore desiring that these officers should be of the Mysore Public Works Department.

50 contentious.

51 and 52. Reply will be put in by Mysore.

53 to 55 accepted.

56 Madras Representative will refer this to his Government with a view to revision.

Mysore 32 *tentative rules.*

I and II accepted.

III and IV contentious.

V to IX accepted.

Note.

Paragraphs 2 and 3 contentious.

Paragraph 4. Four years accepted in place of six.

Paragraphs 5 to 7 contentious.

Paragraph 8 accepted.

M. NETHERSOLE,
Assessor.

7th May 1914.

Ootacamund, Friday, 8th May 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Read note by Assessor on My. 31 as follows:—

1. In reference to the representation of Mysore (My. 31) in which they again ask for modification of the Award on the item of hot weather supply, I have been asked by the Arbitrator to put up a further note in extension of the opinion which I recorded in proceedings of 26th February 1914 to the effect that Mysore had already had ample opportunity before the delivery of the Award under clause 2 (*b*) to produce the evidence and arguments which in My. 19 and 20 they advanced for the same purpose.

2. I wish first to clear a misconception which Mysore appear to entertain as evidenced in paragraph 2 (1) of their forwarding letter No. C. 126 of 4th May in which they state that they are constrained to press for an alternative award because it would be impossible to act up to the Award when the first stage of the reservoir comes into operation.

3. Now the present Arbitration relates to the second or larger stage of the reservoir and the Award under clause 2 (*b*) for hot weather supply clearly refers only to that stage.

4. For the first stage of the reservoir the Madras Government has already given its consent; and for that stage the conditions of consent are those defined in the Mysore Project (My. 5) in which 750 cusecs were shown as the discharge for power. I submit, for consideration of the Arbitrator, that this provision of 750 cusecs constant for power is of the nature of an essential consideration inherent to the consent given by Madras and that it stands in relation to the first stage of the

reservoir as a contract by which Mysore are bound and to which Madras are unquestionably entitled, quite irrespective of the Award under the present arbitration, and therefore, until the second stage of the reservoir comes into operation, Mysore are not bound to pass on more than this quantity. The first plea under which Mysore ask for an alternative award on this item is therefore invalid.

5. I will now consider whether this supply should be considered as delivered at the reservoir or at Sivasamudram. It is in evidence that the present power installation requires a steady 500 cusecs approximately at Sivasamudram—*vide* proceedings of 1st April 1914, and the additional power installation to ensure which the first stage of the reservoir was designed, was to increase the existing power by approximately 50 per cent. Madras were therefore quite justified in regarding the 750 cusecs discharge allotted for power in the first stage of the project as required at Sivasamudram. Further, it is in evidence that owing to existing tanks and other withdrawals for irrigation in the Kannambadi catchment the Kabbini supplies for very low stages of the river are more dependable than are those of the Kannambadi. It was Mysore who pressed for some credit for Kabbini supplies for the purpose of working tables even when the Kannambadi records showed there was nothing in the river at Kannambadi and they also acquiesced in the Kabbini discharge for days on which records of the Sivasamudram discharge were not available in this season being taken as 1·5 times that of the Kannambadi -*vide* proceedings of 26th February 1914 (2) and (3). Hence the provision of 750 cusecs in their project as delivered from the reservoir is quite compatible with the assumption of 750 cusecs as being necessary for power purposes at Sivasamudram; the assumption being that they contemplated at times having to pass 750 cusecs from their reservoir in order to ensure 750 cusecs at Sivasamudram, losses *en route* being covered by the replenishment from the Kabbini. Finally, this general reasoning from the evidence is very strongly confirmed by the memorandum on the quantity of water required at Sivasamudram given in My. 19 allowing reasonable working margin to cover leakage, etc.

6. On all these grounds, I am bound to advise the Arbitrator that Madras were quite justified by the Mysore representations regarding the first stage of the project in supposing that they might expect a minimum supply of 750 cusecs as at Sivasamudram under the operation of the first project and that this minimum supply must be held to be of the nature of an essential consideration under which the consent of the Madras Government to the reservoir in that stage was given; and therefore that Mysore has no justification for claiming any amendment or alteration of that essential consideration now that the work has been so far advanced.

7. Turning now to the second plea advanced by Mysore for an alternative award for this item, *viz.*, that even in the second stage the Award would be unworkable unless the storage in the Kannambadi Reservoir is to some extent to be set apart for the benefit of Madras without any reference to the actual demand for power.

8. I may remark that provision for power is, and always has been, an essential factor of the project whether in the first or second stage. It is also quite clear that the second stage contemplated an ultimate extension of power over and above that contemplated in the first stage, and, on exactly similar reasoning to that I have applied to the 750 cusecs entered in the project as the constant supply for the first stage for power in showing that the inference that this supply was required at Sivasamudram was a logical and fair inference; so too, the inference is also a fair and logical one that it was 1,000 cusecs at Sivasamudram which was contemplated as the ultimate constant discharge in the second stage. Whether it would ever be necessary to pass the whole of this supply from the reservoir or not is immaterial so far as it affects this arbitration. Hence the Madras offer to waive all claims to hot weather supply in the river in consideration of a constant 900 cusecs at Sivasamudram was an eminently fair and reasonable one allowing a fair and reasonable working margin.

9. Throughout the arguments on the issue under 2 (*b*), Mysore never seriously questioned this quantity but only questioned the extent of the Madras prescriptive right to the hot weather supplies in the event of the waiver being withdrawn. The following extract from My. 7 (78) is peculiarly pertinent in this connection.—

"The claim for a constant flow of 900 cusecs in the hot weather, that is, from March to May, now put forward by Madras, is not based on any prescriptive right.

. . . . Even if the waiver is now withdrawn, they are only entitled to the natural flow of the river after the customary Mysore requirements are satisfied. But the interception at the reservoir of the small flow in the hot weather will be more than compensated for by the artificial increase of the river flow below Sivasamudram, which will be caused by the power works as well as by the tail water from new irrigation."

10. Subsequently the arguments developed on the lines of what were the prescriptive rights of Madras in the hot weather flow which I have already reviewed in A.E. Part II, paragraphs 106-113. Now as to this, as I have already pointed out in A.E. II (117) the evidence is very incomplete: the only data in evidence are the records of river flow at Sivasamudram put in with My. 13 (a). These are known to be excessive and the Dhanakere gaugings have shown that the excess is probably about 12 per cent.

11. Now looking at the records of the five years for which figures are given in the Mysore Exhibit 13 (a), it will be seen that the totals of the average daily supplies reckoned half-monthly for eight half-months, 1st February to 31st May, for the five years, aggregate 10,115 cusecs, and average 1,264 cusecs; deducting 12 per cent from this to correct the excess proved by the Dhanakere gaugings, would give 1,112 cusecs as the estimated average supply passing Sivasamudram for the whole period.

12. Taking the worst year 1905, the aggregate of the Mysore figures would be 8,625 cusecs; the average 1,078 cusecs; and as corrected by the Dhanakere gaugings, 949 cusecs. And these are the figures, *viz.*, 1,112 cusecs as the average for five years, and 949 cusecs as an average for the worst year on record, which have to be compared with the 900 cusecs of the Award.

13. If, therefore, an alternative to the award were to be offered, the lowest figure which on this evidence I could suggest to the Arbitrator as a proper estimate of the prescriptive rights of Madras to the supply at this season is the former figure, *viz.*, 1,112 cusecs.

14. It is an alternative which it is not to be supposed that Mysore would accept and I need only record my final opinion that Mysore have shown no sufficient justification for any amendment of the Award already given in respect to this item.

Read Arbitrator's decision as follows:—

Madras having signified their consent to the smaller project which provided for the passing down of 750 cusecs at Sivasamudram are entitled as of right to that quantity.

The project for the larger reservoir contemplated the ultimate passing down of 1,000 cusecs for power at Sivasamudram. Madras consented to accept a steady flow of 900 cusecs which as the Assessor has shown from the data available is less than the average estimated natural flow during the hot weather months.

The question is not one of the prescriptive rights of Madras but of a right which arises out of a contract or quasi-contract between the parties.

I entirely agree with the Assessor that no cause has been shown for revision of the Award.

The proceedings before the Assessor on the 7th May are by consent of parties confirmed.

Read enquiry by the Madras Representative as regards paragraph 24, Part III, Assessor's Examination of Evidence as follows:—

(1) Reference to the third (or proportionate) system referred to in paragraph 24, allusion is made to the Madras "Interpretation" of the application of this system.

(2) In describing the Mysore system, A.E., paragraph 13, the Assessor has given an algebraic representation of it, but in describing the proportionate system, paragraphs 16 to 19, no such representation is given.

(3) The Madras Representative had always understood that there was no difference of understanding or interpretation as regards the application of the third

system and Mysore have, it is represented, interpreted it in exactly the same way as Madras; and that this is so is, it is submitted, proved by the fact that in their working tables they applied the system in exactly the same way as Madras. No other application or interpretation of the system has, it is represented, been considered throughout the proceedings.

(4) The Madras "interpretation" of the system is given in algebraic form below:—

F is the proportion factor which discharge at Kannambadi bears to the Cauvery discharge at Cauvery Dam.

Kn is the observed discharge at Kannambadi.

C is the limit flow under the Award.

I is the quantity Mysore is permitted to impound on any day under the Madras interpretation of the third (proportionate) system

$$I = (Kn. - FC.).$$

(5) It is asked that, if any other interpretation of this system is considered by the Assessor to have been understood by either party, he will give a statement in similar algebraic form demonstrating such interpretation and give reference to any of the proceedings in which such interpretation is suggested or referred to.

The Assessor will give his written opinion later.

*Ma. 36.	Madras put in further statement* on the "rules" [term of reference 3 (*b*)].
*Ma. 37. Ma. 37 (1). (2). (3). (4).	Madras put in a reply* to the Mysore note on the working tables My. 33 with tables appended.
*My. 35.	Mysore put in a reply* to the Madras statement Ma. 35 on issues 3 (*b*) and 4, also a note My. 36 with a table showing effect on results of taking a discharge of 900 instead of 1,000 at Sivasamudram.

The proceedings are adjourned to May 12th.

H. D. GRIFFIN,
Arbitrator.

8th May 1914.

Ootacamund, Saturday, 9th May 1914.

PRESENT.

M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Recorded Assessor's reply to Madras enquiry as to paragraph 24, Part III, of Assessor's Examination:—

In reply to the enquiry by the Madras Representative as regards paragraph 24, Part III, I may at once say that the Madras interpretation of the proportionate system did not differ in any way from the interpretation of it which was intended in my illustration given in Part II of my Examination of the Evidence nor does it differ in any way from the interpretation of it put on it by Mysore. The remarks in this paragraph to which Madras refer were not intended to suggest anything to the contrary and still less to suggest that Madras had misinterpreted it in any way. It would perhaps clear the paragraph from any risk of future misunderstanding of my actual meaning if the word "application" had been used instead of

the word "interpretation" and I propose issuing herewith the following correction notice accordingly :—

In paragraph 24 of A. E. III for the word "interpretation" which occurs twice in the sixth line, substitute the word "application." I also take this opportunity of making the following correction in the equation representing the Mysore method given in paragraph 13, Part III, which should read (P Kn — C)$\frac{100}{100-t}$ or (P Kn — C) $\frac{100+t}{100}$ according as to the transmission loss is reckoned on the Kannambadi or Cauvery flow, instead of as written where the P was intended to combine both the proportion and transmission factors.

Recorded Ma. 38 being a reply to My. 36.

Considered non-contentious matters of rules with a view to final adoption.

M. NETHERSOLE,
Assessor.

9th May 1914.

Ootacamund, Tuesday, 12th May 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

The parties agree to the non-contentious rules Nos. 1 to 22.

The Assessor read his Examination * of the Evidence on the remaining part of terms of reference 3 (a), term of reference 3 (b) and the fourth and final term of reference.

*Printed further on.

The Arbitrator delivered his Awards * on the terms of reference above.

*Printed further on.

Ma. 39. The Madras Representative puts in a note on the gauge-readings during the tentative period.

The Mysore Representative states that he accepts the Madras proposals contained in Ma 39.

The proceedings are adjourned to to-morrow. Any representation either party may wish to make regarding the Award will then be considered.

H. D. GRIFFIN,
Arbitrator.

12*th May* 1914.

Ootacamund, Wednesday, 13th May 1914.

PRESENT.

SIR H. D. GRIFFIN—*Arbitrator.*
M. NETHERSOLE, ESQ.—*Assessor.*
COL. W. M. ELLIS, R.E.—*Representative of the Madras Government.*
MR. KARPUR SHRINIVASRAV—*Representative of the Mysore Government.*

Copies of records of gaugings put in by parties as called for in the proceedings of the 29th April 1914.

The list of days or periods for which gauge records are missing is placed on record of the proceedings.

Periods for which Mysore gauge registers are missing.

I—Sivasamudram Anicut.

1910--
28th January.
10th February.
14th, 16th, 17th February.
21st April.
25th ,,
30th July.
1911—
10th—16th September.
29th October.
4th December.

1912--
20th January.
27th May.
10th June.
17th October.
5th December.
1913—
14th March.
1st, 2nd December.

II—Chick Devaroy Sagar Anicut.

3rd March 1913.
2nd—10th May 1913.
3rd to 9th August 1913.
14th to 16th August 1913.

Devaroy Anicut.

1st November 1911 to 13th June 1912, no entries.

III—Ayerhalli Anicut.

3rd to 9th September 1912.
2nd to 14th December 1913.

IV—Chamraj Anicut.

9th to 12th July 1913.
28th to 31st July 1913.
1st to 5th August 1913.

V—Hulhalli Anicut.

8th to 10th January 1913.
23rd February 1913.
8th April 1913.
26th to 30th June 1913.

The Madras records of gaugings (copied by Mysore) are numbered Ma. 40 and Ma. 41.

The Mysore records of gaugings (copied by Madras) are numbered My. 37 (1 to 25).

The Volumes I and III of the Metur Project hitherto not brought on to the record are now numbered as Exhibits A-8 (1) and A-8 (2).

The proceedings then terminated.

H. D. GRIFFIN,
Arbitrator.

13*th May* 1914.

List of papers filed before the Arbitration Committee.

(i) Exhibits filed by the Assessor.

A-1.—Note by Col. Ellis, R.E., on the question whether any proportion can be fixed between the seasonal flow of the Cauvery at Kannambadi and the flow of the Aganda Cauvery.

*A-1-a.—Diagram showing half-monthly discharges of the Cauvery at Kannambadi and Upper Anicut for 1896 to 1908—Enclosure to above.

A-2-.—Note by the Assessor on the method of computing yield from Kannambadi catchment, dated 7th November 1913.

A-3.—Note, dated 20th November 1913, by the Madras Representative on the computations of yield of the Cauvery at Kannambadi prepared under the instructions of the Assessor.

A-3-a.—Note, dated 25th November 1913, by the Assessor containing his direction on the above.

A-3-b.—Note, dated 18th December 1913, by the Mysore Representative containing remarks on the computations for finding the discharges in the B catchment.

A-4.—Note, dated 25th November 1913, by the Madras Representative on the examination of the figures of discharges of the Cauvery and Vennar shown in Sir J. Benton's note of 12th May 1911.

A-4-a.—Note, dated 26th November 1913, by the Assessor containing his reasons for rejecting the method of computations of sluice discharges for years subsequent to 1905-06.

A-4-b.—Note, dated 26th November 1913, by the Assessor on the various diagrams used for the computations of the volumes taken into the Cauvery and Vennar channels.

A-4-c.—Further note by the Madras Representative on discharges of Cauvery-Vennar below the head regulators, dated 12/18th December 1913.

A-5.—Note, dated 29th November 1913, by the Assessor containing his direction on the diagrams based on the table Appendix XIX of Ma. 13 for computation of daily discharges at Kannambadi, Kabbini and Sivasamudram.

A-6.—Note, dated 3rd December 1913, by the Assessor regarding the origin of the figures of river supplies entered by Sir J. Benton in Appendix V of his note of 12th May 1911 suggesting the comparison of the discharges over the Cauvery Dam on the figures of Major Montgomerie's curve with those given by Sir J. Benton in his note referred to.

A-6-a.—Note, dated 4th December 1913, by the Madras Representative showing the results after comparison suggested by the Assessor.

A-7.—Note, dated 17th December 1913, by the Assessor containing extracts from the Madras and Mysore Government records examined by him.

*A-8 (1) & (2).—Volumes I and III of the Madras Metur Project.

(ii) Exhibits filed by the Madras Government.

(PRINTED IN VOLS. II & III.)

Ma. 1.—Brief statement of case put in by Madras.

Ma. 1-a—Accompaniment to Ma. 1—Provisional rules defining the method of passing down supplies required for irrigation in the Madras Presidency.

Ma. 1-b—Telegram from the Government of India, Public Works Department, No. 981-I., dated 5th July 1913.

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* Not printed.

Ma. 1-c.—Conditions of Arbitration put in by Madras—Note regarding —, dated 21st July 1913.

Ma. 1-d.—Note, dated 21st July 1913, by the Madras Representative.

*Ma. 1-e—Information required from Mysore by Madras—Note regarding—, dated 21st July 1913.

*Ma.1-f—Note, dated 26th July 1913, regarding handing in copies of triennial reports, 1901-02 and 1904-05, to the Mysore Representative.

Ma. 2.—Madras version copy of rules and Agreement of 1892.

Ma. 3.—Reply of the Madras Government to the statement of the Mysore case presented on 21st July 1913 including reply of Madras to the Mysore provisional rules for working the Mysore reservoir.

*Ma. 3-a.—List, dated 29th July 1913, of irrigation maps of the Cauvery and its tributaries and Coleroon, and statements of Lower Anicut discharges and of daily discharges at Grand Anicut and through Cauvery-Vennar regulators, handed over to the Mysore Representative.

Ma. 3-b.—Note, dated 29th July 1913, by the Madras Representative regarding settlement of issues before the Mysore Rejoinder.

Ma. 4.—Rejoinder of the Madras Government to the rejoinder presented by the Mysore Durbar on 4th August 1913.

Ma. 5.—Suggested terms of reference by the Madras Government.

Ma. 6.—Protest by Madras regarding information required of Mysore.

Ma. 6-a.—Letter No. 262-O—13-9, dated 9th September 1913, from the Joint Secretary to Government, Public Works Department, Madras, to M. Nethersole, Esq., Inspector-General of Irrigation, Simla.

Ma. 6-b.—Letter No. 38-I.G., dated 16th September 1913, from M. Nethersole, Esq., Inspector-General of Irrigation and Assessor, Mysore-Madras Arbitration, to the Joint Secretary to the Government of Madras, Public Works Department (Irrigation Branch), Madras.

Ma. 6-c—Note by Assessor on the protest put in by Madras in Ma. 6.

Ma. 6-d.—Enquiry by the Madras Representative with reference to the Assessor's reply (Ma. 6-c).

Ma. 6-e.—Reply by the Assessor to the enquiry made by the Madras Representative.

Ma. 7.—Part I, Madras case— Legal arguments, first and second issues.

*Ma. 7-a.—Madras G. O. No. 343 I., dated 15th July 1889.

Ma. 8.—Part II, Madras case —Historical and descriptive.

Ma. 8-a—Madras G. O. No. 292 I., dated 18th September 1911.

Ma. 9.—Part III, Madras case—Engineering arguments, second issue.

Ma. 9-a.—Note regarding population affected by irrigation below the Upper Anicut.

Ma. 10.—Part IV, Madras case—Engineering arguments, third issue.

*Ma. 10-a.—Notes of Assessor's inspection of the Sivasamudram Anicut during August 1913.

*Ma. 10-b.—Diagram of half-monthly discharges and rainfall—Sivasamudram-Bhavani Bridge and Upper Anicut.

*Ma. 10-c.—Diagram M—Working tables (M system) for 1905 with limit of flow at the Upper Anicut, 2,944 millions cubic feet per day.

*Ma. 10-d.—Diagram N—Working tables (N system) for 1905 with limit of flow at the Upper Anicut, 2,300 millions cubic feet per day.

Ma. 11.—Madras Rejoinder, Part V, Legal arguments.

Ma. 12.—Madras Rejoinder, Part VI, Facts and Engineering arguments, second issue.

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* Not printed.

Ma. 13.—Madras Rejoinder, Part VII, Facts and Engineering arguments, third issue.

*Ma. 13-a.—Diagram showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam—year 1899.

*Ma. 13-b.—Diagram showing the effect of impounding on the flow at the Cauvery Dam—year 1902.

*Ma. 13-c—Diagram showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam—year 1905.

*Ma. 13-d.—Diagram showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam—year 1913.

Ma. 14.—Madras Rejoinder to Mysore Reply My. 9, Parts VIII to X.

Ma. 15.—Statement, dated 7th January 1914, by the Madras Representative, of area of irrigation under the Cauvery channels between Bhavani and Upper Anicut requiring water between February and June.

Ma. 15-a.—Statement, dated 7th January 1914, by the Madras Representative, showing areas and perennial crops under channels fed by the Cauvery between Bhavani and Upper Anicut for years 1890, 1895 and 1900.

Ma. 16.—Further extracts of Madras records put in by Madras as addenda to Exhibit A-7.

Ma. 17.—Note, dated 8th January 1914, by the Madras Representative, on the comparative cross sections of the Cauvery between the Cauvery Dam and the Grand Anicut.

Ma. 17 (a).—Note, dated 10th January 1914, by the Madras Reprsentative, regarding the average bed levels of the Cauvery called for by the Assessor.

Ma. 17-b.—Note, dated 13th January 1914, by the Madras Representative regarding the levels of the river bed at the Cauvery Dam.

Ma. 18.—Note, dated 20th January 1914, by the Madras Representative, regarding the Cauvery channels above the Upper Anicut.

*Ma. 18-a.—Curve showing relation between Cauvery Dam north gauge-readings and Pugalore channal gauge-readings in the years 1911, 1912, 1913, during the months of June, July and August for gauge-readings (3 to 7½ feet) on the Cauvery Dam when Upper Anicut shutters were closed.

*Ma. 18-b.—Curve showing relation between Cauvery Dam north gauge-readings and front gauge-readings of Wyyacondan head-sluice (full supply reading 5·75) for 1910 to 1913, June to August.

*Ma. 18-c.—Curve showing relation between Cauvery Dam north gauge-readings (Upper Anicut closed) and Marudur Nattu Voikal head-sluice gauge-readings (full supply gauge 5·00) for 1912 and 1913, June to August.

*Ma. 18-a-1.—Statement of gauge-readings, Cauvery Dam and Pugalore channel.

*Ma. 18-b-1.—Statement of gauge-readings, Cauvery Dam and Wyyacondan channel.

*Ma. 18-c-1.—Statement of gauge-readings, Cauvery Dam and Marudur Nattu Voikal.

Ma. 19.—Note, dated 19—20th January 1914, by the Madras Representative, submitting a table showing the resulting combined discharges of the Cauvery and Vennar regulators with reference to Appendix XXII of Ma. 14.

Ma. 20.—Note, dated 20th January 1914, by the Madras Representative, regarding the yearly record of remissions due to deficiency of supplies of water in the Cauvery delta in the twenty years 1890 to 1909.

Ma. 21.—Note, dated 2nd February 1914, by the Madras Representative, in Reply to My. 15.

*Ma. 21-a.—Diagram showing the positions of koramboos in the Cauvery—enclosure to the above.

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* Not printed.

Ma. 22.—Madras third Rejoinder to Mysore Reply My. 12, XI—XIII.

Ma. 23.—Summary of the Madras case.

Ma. 23-a.—Index of paragraphs of Legal arguments—first and second issues.

Ma. 23-b.—Index of paragraphs of Engineering arguments—first and second issues.

Ma. 24.—Note, dated 18th March 1914, by the Madras Representative, on the third issue as affected by finding on second issue.

*Ma. 24-a (1—13).—Working tables, table IX, for the years 1896-97 to 1908-09.

*Ma. 24-b (1—13).—Working tables, table X, for the years 1896-97 to 1908-09.

*Ma. 24-c (1—13).—Working tables, table XI, for the years 1896-97 to 1908-09.

*Ma. 24-d (1—13).—Working tables, table XII, for the years 1896-97 to 1908-09.

Ma. 24-e.—Abstract of results from table X with proportions ·65 and ·425.

Ma. 24-f.—Abstract of results from table X with proportions ·6 and ·4.

*Ma. 24-g-1.—Mysore system, table IX, Diagram showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam, year 1908.

*Ma. 24-g-2.—Mysore system, table IX, Diagram showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam, year 1905.

*Ma. 24-g-3.—Mysore system, table IX, Diagram showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam, year 1904.

*Ma. 24-g-4.—Mysore system, table IX, Diagram showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam, year 1902.

*Ma. 24-g-5.—Mysore system, Table IX, Diagram showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam, year 1898.

*Ma. 24-h-1.—Mysore system, Table XI, Diagram showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam, year 1908.

*Ma. 24-h-2.—Mysore system, Table XI, Diagram showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam, year 1905.

*Ma. 24-h-3.—Mysore system, Table XI, Diagram showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam, year 1904.

*Ma. 24-h-4.—Mysore system, Table XI, Diagram showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam, year 1902.

*Ma. 24-h-5.—Mysore system, Table XI, Diagram showing the effect of impounding at Kannamdadi on the flow at the Cauvery Dam, year 1898.

Ma. 25.—Note, dated 31st March 1914, by the Madras Representative on the third issue in reply to My. 21.

Ma. 25-A 1 to 13.—Abstracts of working tables XII for thirteen years, 1896-1897 to 1908-1909, with limits of flow of 2,944 and 2,300 millions cubic feet and for natural flow at the Cauvery Dam.

Ma. 25-B 1 to 13.—Abstracts of working tables X for thirteen years, 1896-1897 to 1908-1909, with limits of flow of 2,944 and 2,300 millions cubic feet and for natural flow at the Cauvery Dam.

Ma. 25-C 1 to 5.—Abstract of working tables III, Mysore system (corrected tables), for five years for limits of flow of 2,944, 2330 and 1,966 millions cubic feet and for natural flow at the Cauvery Dam.

*Ma. 25-D.—Corrected table III for factors 1·6 and 3·33 for thirteen years, 1896-1897 to 1908-1909.

*Ma. 25-E.—Corrected table III for factors 1·8 and 4 for thirteen years, 1896-1897 to 1908-1909.

*Ma. 25-F 1 to 5.—Diagrams showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam for years 1898, 1902, 1904, 1905 and 1908, (Mysore table III corrected).

Ma. 26.—Note, dated 9th April 1914, by the Madras Representative on third issue on the yield of the combined Kannambadi and Kabbini catchments.

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* Not printed.

Ma. 26-a.—Statements showing half-monthly yield of catchments for years 1902-1903 to 1908-1909.

Ma. 27.—Note, dated 11th April 1914, by the Madras Representative on the third issue in reply to My. 24.

Ma. 28.—Note, dated 21st April 1914, by the Madras Representative regarding the examination of the fourth issue.

Ma. 29.—Note, dated 21st April 1914, by the Madras Representative containing representations of Madras that the working conditions and prospects of Mysore Reservoir are material to Arbitration.

Ma. 30.—Note, dated 22nd April 1914, by the Madras Representative containing representations regarding the Arbitrator's finding and award on the issue 3 (a).

Ma. 30-a.—Note, dated 22nd April 1914, by the Madras Representative containing reference to paragraphs regarding the modified Madras system.

Ma. 31.—Note, dated the 14th/22nd April 1914, by the Madras Representative on duties Mysore Reservoir.

Ma. 32.—Note, dated 29th April 1914, by the Madras Representative containing Madras Reply to (My. 28) Mysore note of 26th April 1914.

Ma. 33.—Note, dated 29th April 1914, by the Madras Representative containing representations regarding the award on issue 3 (a) asking for revision of the award on the point (c) in the note.

Ma. 34.—Note, dated 1st May 1914, by the Madras Representative regarding the period of south-west and north-east monsoons.

Ma. 35.—Statement of case, dated 5th May 1914, by the Madras Representative regarding Issues 3 (b) and 4.

*Ma. 35 (1—13).—Working tables II for the years 1896 to 1908 with the proportionate factors ·625 for south-west monsoon and ·30 for the north-east monsoon.

Ma. 36.—Madras further note on rules and arrangements for working Kannambadi Reservoir.

Ma. 37.—Reply by the Government of Madras to Mysore note on the working tables (My. 33).

Ma. 37-1.—Statement showing balance in Mysore Reservoir on 1st June of every year with quantity received and issued during the year (check of Mysore statement C).

Ma. 37-2.—Statement showing balances at end of each half month for years 1896—1908.

Ma. 37-3.—Statement showing opening balances, receipts, issues and deficiencies.

Ma. 37-4.—Statement showing closing balance in Mysore Reservoir at end of September or October, classification, issue and deficiency from October or November to June 15th.

Ma. 38.—Note, dated 9th May 1914, by the Madras Representative in reply to My. 36 regarding revised classification with 900 cusecs basis.

Ma. 39.—Note, dated 12th May 1914, by the Madras Representative on gauge readings during the tentative period.

**Madras records of gaugings (copied by Mysore).*

Ma. 40.—Extract from water registers showing gauge-readings at the Cauvery Dam from 1st January 1910 to 30th April 1914.

Ma. 41.—Extract from water registers showing gauge-readings at Bhavani Bridge across the Cauvery from 1st January 1910 to 30th April 1914.

* Not printed.

(iii) Exhibits filed by the Mysore Government.

(PRINTED IN VOLS. II & III.)

My. 1.—Statement of case put in by Mysore, dated 17th/21st July 1913.

My. 1-a.—Terms of reference to the Committee of Arbitration proposed by Mysore.

*My. 1-b.—Statement of information required from Madras by Mysore, Note regarding—, dated 22nd July 1913.

My. 2.—Provisional rules for working the Mysore Reservoir, Note containing—, dated 26th July 1913.

My. 2-a.—Mysore version copy of rules and Agreement of 1892 defining the limits within which no new irrigation works are to be constructed by the Mysore State without previous reference to the Madras Government—given by Mysore.

My. 2-b.—Supplemental note, dated 26th July 1913, of the Mysore Representative to the provisional rules.

*My. 3.—List, dated 29th July 1913, of papers handed over to the Madras Representative.

*My. 3-a.—Explanatory note referred to in paragraph *A* of Exhibit My. 3, papers handed over to the Madras Representative.

My. 4.—Rejoinder by the Mysore Durbar to the reply presented by the Madras Representative to the Committee of Arbitration on 29th July 1913.

*My. 5.—Cauvery Reservoir Project Report of Mysore.

My. 6.—Statement of Mysore case with special reference to the Madras case presented on 21st October 1913, to the Arbitration Committee.

My. 7.—Part II—Mysore case (Prescriptive rights).

*My. 7-a.—Diagram. Enclosure to above.

My. 8.—Part III—Mysore case (Place and mode of measurement).

My. 9.—Mysore Reply to the Madras Rejoinder presented on the 27th November 1913, with appendices

*R-1.—Table III-B, 1899.

*R-1-a.—Diagram showing the effect of impounding at Kannambadi on the flow at the Cauvery Dam—year 1899—accompaniment to the above.

*R-2.—Table III-B, 1902.

*R-2-a.—Diagram showing the effect of impounding at Kannambadi on the flow of the Cauvery Dam—year 1902—accompaniment to the above.

*R-3.—Table III-B, 1905.

*R-3-a.—Diagram showing the effect of impounding at Kannambadi on the flow of the Cauvery Dam—year 1905—accompaniment to the above.

*R-4.—Table III-B, 1913.

*R-4-a.—Diagram showing the effect of impounding at Kannambadi on the flow of the Cauvery Dam—year 1913—accompaniment to the above.

My. 10.—Extract from the Report of the Indian Irrigation Commission, 1901—1903, Part II—Provincial.

My. 11.—Copies of correspondence relating to the Marikanave Reservoir Project filed by the Mysore Representative.

My. 12.—Mysore Reply to the Madras second Rejoinder of 6th January 1914.

My. 13.—Note, dated 28th January 1914, by the Mysore Representative on the average estimated natural flow at Sivasamudram during the hot weather.

My. 13-a.—Statement showing the average estimated natural flow of the Cauvery at Sivasamudram. Enclosure to the above.

My. 14.—Note, dated 28th January 1914, by the Mysore Representative on the remissions and loss of crops in the Cauvery delta.

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* Not printed.

My. 15.—Note, dated 28th January 1914, by the Mysore Representative on the Cauvery channels above the Upper Anicut.

My. 16.—Summary of the Mysore case on the first and second terms of reference framed by the Arbitration Committee.

My. 17.—Statements of areas of irrigation in the Cauvery basin both above and below the Mysore Reservoir site.

My. 18.—Statement of appendices to the Mysore case giving a brief description of the object of each appendix.

My. 19.—Note on the quantity of water to be issued for power generation from the storage of the Kannambadi Reservoir for preparing the working tables and also tentative rules for working the Kannambadi Reservoir for different conditions of storage.

My. 19-a.—Note, dated 2nd March 1914, by the Mysore Representative regarding tentative rules for working the Kannambadi Reservoir for different conditions of storage.

My. 20.—Note, dated 18th March 1914, by the Mysore Representative regarding the question of the hot weather supply.

My. 21.—Note, dated 18th March 1914, by the Mysore Representative on the working tables based on the Mysore system of measurement in connection with the third issue.

My. 21-a.—Statement A of proportion between Cauvery Dam flow and Kannambadi flow for the years 1896-97 to 1908-09.

My. 21-b.—Statement B—Abstract of working tables.

My. 21-c.—Statement C—Abstract of working tables, table III.

My. 21-d.—Statement D—Abstract of working tables.

My. 21-e.—Statement E—Abstract of working tables, table III.

My. 21-f.—Statement F—Abstract of working tables, tables I and III.

My. 21-g.—Statement G—Showing the quantity of compensation water and the number of days on which it becomes due (for years 1896 to 1908).

*My. 21-h.—Working tables, table I, 1896 to 1908.

*My. 21-i.—Working tables, table II, 1896 to 1908.

*My. 21-j.—Working tables, table III, 1896 to 1908.

My. 22.—Note, dated 31st March 1914, by the Mysore Representative on the third issue in reply to Ma. 24.

My. 22-a.—Note, dated 1st April 1914, by the Mysore Representative on sample table showing the advantage of the combined system or the third system including the Kabbini over the third system applied to Kannambadi catchment only.

My. 22-1.—Statement H-1 shewing percentages of compensation water due on resulting flow up to different limits, proportion 1·6 and 3·33.

My. 22-2.—Statement H-2 showing percentages of compensation water due on resulting flow up to different limits, proportion ·7 and ·45.

My. 22-3.—Statement K (Madras Table IX), proportion ·7 and ·45.

My. 22-4.—Statement L (Madras Table XI), proportion ·6 and ·4.

My. 22-5.—Statement M (Madras Table X), proportionate system, proportion ·65 and ·425.

My. 22-6.—Statement N (Madras Table XII), proportionate system, proportion ·6 and ·4.

My. 22-7.—Statement P showing the percentages of quantity lost by Madras under different methods examined on the natural flow up to limit 1,966 millions cubic feet.

My. 23.—Mysore Rejoinder to the Madras Note on third issue (Ma. 25).

My. 24.—Further Note, dated 6th April 1914, by the Mysore Representative to Madras note, Ma. 25, Working tables.

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* Not printed.

Assessor's Exhibits.

Exhibit A-1.

Note.

For the purpose of examining whether any proportion could be fixed between the seasonal flow of the Cauvery at Kannambadi and the flow of the Cauvery (Aganda Cauvery) at the Upper Anicut, a diagram has been prepared showing by half-monthly periods the flow of the Cauvery past Kannambadi taken from the tables of half-monthly flow furnished by Mysore and the recorded flow half-monthly of the Aganda Cauvery at the Upper Anicut.

In making the computation two days have been allowed for time of transmission. The reason for this is that high floods will pass from Kannambadi to the Upper Anicut in nearly two days and it is high floods which would cause more inaccuracy in results due to time of transmission and normal stages of river flow.

For the purpose of saving time and controversy, the figures of the flow at Kannambadi as furnished by Mysore are utilised. Madras do not accept the figures as giving correct results for the Lakshmanathirtha catchment and the plain catchments below the anicuts of Alalkatte and Sri Ramdevar, but the discharges of these anicuts are accepted and as these form the greater part of the discharge at Kannambadi, the figures of Mysore are adopted as being the only ones available for a consideration of the problem which the Assessor has asked should be studied by both parties.

2. The diagram shows in million cubic feet the half-monthly discharges of the Cauvery at Kannambadi and at the Upper Anicut for the months June to January in each year for which half-monthly records of discharges at Kannambadi have been furnished by Mysore.

Below this, a diagram shows the centages by which the half-monthly flow of the Aganda Cauvery exceeds or is less than the flow of the corresponding half-month at Kannambadi.

A table accompanying shows the ratio which the flow at the Upper Anicut bears half-month by half-month to that at Kannambadi.

3. It will be seen from the diagram and figures that not only is the variation in proportions of total flow very great from year to year, but it is very great when comparing year by year the flow of the same half-month.

4. In the month of July and first half of August the proportion shows less variation than in any other, but it will be seen that even in this month in 1906 the flow at the Upper Anicut was for the first half of the month less than the flow at Kannambadi, while in the year 1902 it only exceeded it by 17 per cent. On the other hand, in 1900 the flow at the Upper Anicut was over $2\frac{1}{2}$ times that at Kannambadi.

The average ratio—

$$\frac{\text{Discharge at Upper Anicut}}{\text{Discharge at Kannambadi}} \text{ is } \ldots \quad \ldots \quad \ldots \quad 1{\cdot}627$$

For the second half of July in 1900 and in 1907 the flow was only 15 per cent greater at the Upper Anicut than at Kannambadi, while in 1898 it was $3\frac{3}{4}$ times as great.

The average ratio—

$$\frac{\text{Discharge at Upper Anicut}}{\text{Discharge at Kannambadi}} \text{ is } \ldots \quad \ldots \quad \ldots \quad 1{\cdot}644$$

In the first half of August in 1899 the flow at the Upper Anicut was only 5 per cent greater than that at Kannambadi and the flow in 1898 was only 15 per cent greater, while the flow in 1906 was $2\frac{1}{2}$ times as great at the Upper Anicut as at Kannambadi.

The average ratio—

$$\frac{\text{Discharge at Upper Anicut}}{\text{Discharge at Kannambadi}} \text{ is } \ldots \quad \ldots \quad \ldots \quad 1{\cdot}616$$

For the other half-months of the irrigation season the variation of the ratio in different years is materially greater than the above.

5. As was expected, the seasonal variation of average ratio is considerable, the proportion in October and November being materially greater than in the south-west monsoon or the dry months.

6. It will be noted that, in a year in which the north-east monsoon fails (notably 1904), very low ratio figures are recorded, while the reverse is the case for good north-east monsoon years such as 1898.

7. It is considered that any settlement on the basis of a fixed half-monthly proportion between the flow of the Cauvery at Kannambadi and at the Upper Anicut which will "conserve unimpaired" the rights of Madras, must not be materially greater than the minimum recorded proportion.

Nothing even approaching the average proportion could conserve unimpaired the rights of Madras and the table shows clearly that, even for the short period of thirteen years for which there are figures, serious shortages of water must result from fixing a proportion differing greatly from the minimum recorded.

8. On the other hand, the minimum proportion differs so greatly from the average that adopting these or any figures approximating to these as fixed proportions must result in leaving to Mysore much less water for impounding than under a system of daily measurements of the discharges of the Cauvery, Hemavati, Lakshmanathirtha and Kabbini proposed by Madras.

Further, it is pointed out that under the system of fixed proportions it will be necessary to measure daily the flow of the three first-named rivers and this being so, the extra labour and complication of working the system proposed by Madras would not be great.

9. The Madras Government are willing to make any further examination which may be proposed or desired by the Assessor. It is desired that, if the Assessor wishes further diagrams, figures or tables worked out, he will kindly indicate the lines under which he would wish work to be carried out and the matter will receive immediate attention.

W. M. ELLIS, COL., R.E.,
Representative of Madras Government.

23*rd August* 1913.

Statement showing ratio of the recorded half-monthly flow of the Aganda Cauvery at the Upper Anicut as compared with the flow of the Cauvery at Kannambadi.

—		1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	Average proportion	Proportion of minimum to average
June	First half	5·482	13·782	1·170	1·068	4·521	1·252	·905	2·005	3·022	4·002	5·303	12·936	8·240	4·904	.185
	Second ,,	1·684	2·228	1,855	1·663	1·507	1·637	1·003	1·862	1·768	2·650	·499	1·349	·989	1·592	·313
July	First ,,	1·634	1·998	1·247	1·991	2·619	1·567	1·170	1·775	1·461	1·792	·934	1·663	1·303	1·627	·574
	Second ,,	1·362	1·496	3·760	1·918	1·145	1·499	1·383	1·525	2·104	1·394	1·229	1·150	1·414	1·644	·696
August	First ,,	1·731	1·602	1·152	1·052	2·111	1·490	1·610	1·789	1·822	1·433	2·517	1·225	1·481	1·616	·651
	Second ,,	1·584	3·503	2·055	1·505	1·539	1·380	·823	1·220	1·457	1·157	2·338	1·365	1·243	1·628	·505
September	First ,,	2·461	2·039	1·799	3·062	2·369	2·550	1·249	2·343	·652	1·369	1·376	1·620	1·926	1·908	·342
	Second ,,	3·009	5·577	4·799	3·304	1·405	4·970	1·533	4·046	1·132	1·770	1·557	1·646	1·411	2·781	·406
October	First ,,	3·129	4·180	3·292	1·943	2·638	3·984	3·004	2·929	1·508	3·896	4·036	3·233	1·828	3·054	·491
	Second ,,	2·295	2·546	3·118	2·957	2·503	2·846	4·342	4·082	2·183	2·675	3·711	1·876	3·772	2·993	·627
November	First ,,	5·642	3·326	6·746	5·896	3·047	3·334	3·718	4·991	2·009	2·698	4·649	2·581	5·546	4·168	·482
	Second ,,	4·431	2·861	4·624	1·474	4·254	2·549	5·334	5·066	1·195	3·426	4·079	2·970	2·239	3·423	·349
December	First ,,	6·975	2·730	4·716	1·843	3·508	2·858	2·953	3·180	0·393	3·218	4·714	2·522	12·113	3·979	·099
	Second ,,	9·465	2·608	8·407	1·020	6·328	3·330	3·311	3·297	·404	1·219	4·523	3·086	14·326	4·717	·086
		1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	...	...
January	First ,,	5·805	2·519	8·649	5·505	8·559	8·597	3·371	3·870	·255	·212	6·263	2·416	...	4·688	·045
	Second ,,	3·762	3·033	13·130	1·329	11·825	5·604	3·893	2·710	·713	1·927	2·484	2,921	...	4·444	·060

007529

Enclosure II to A-1.

Letter—from MR. M. NETHERSOLE, Inspector-General of Irrigation in India and Assessor, Mysore-Madras Arbitration case.
To—the Joint Secretary to Government of Madras, Public Works Department (Irrigation Branch).
Dated—Simla, the 5th September 1913.
No.—34-I. G.

I have the honour to acknowledge the receipt of your letter No. 264-0/13-1, dated the 28th August 1913, enclosing a note by Colonel Ellis on the question whether any proportion could be fixed between the seasonal flow of the Cauvery at Kannambadi and the flow of the Aganda Cauvery at the Upper Anicut. It appears from the note that the proportion of the Cauvery supply received from the Kannambadi catchment amounts on the average to roughly ·6 of the whole: it would be useful if this figure were checked by a calculation of the run-off from the relative catchment areas based on the usually accepted ratios on the average rainfall of the south-west monsoon. It will also be useful if you will kindly ask Col. Ellis to work out to what extent Madras supplies would have suffered in the years for which data are available on the assumption that the Mysore reservoir had been in existence and that they had been required to pass on all supplies coming into the reservoir of less volume than ·6 of the maximum supply required at the Upper Anicut; that is to say, assuming, for example, the maximum supply required at the Aganda Cauvery as 26,000 cusecs, to what extent would Madras have suffered if Mysore had passed on all volumes reaching Kannambadi up to a maximum of 16,000 cusecs and had only stored the surpluses over and above this limit.

No. 39-I.G., dated 5th September 1913.

A copy with a copy of the note by Colonel Ellis with its enclosure is forwarded to the Chief Engineer, Public Works Department, Mysore, for information.

Exhibit A-2.

Note by the Assessor on the method of computing yield from Kannambadi catchment, dated the 7th November 1913.

In continuation of my note of 27th October 1913, on the method of computing yield from catchment Kannambadi areas B-1 and B-2, a comparison of yield from those areas worked out by Colonel Ellis by the method defined in that note with the discharges past the Ayerhalli Anicut for certain months of 1913 gives a ratio of about 8 : 7.

Hence, in working out the yield for past years from areas B-1 and B-2, I think it will be safer to apply this ratio to the results obtained by the method laid down in my note of the 27th October.

M. NETHERSOLE,
Assessor, Mysore-Madras Arbitration.

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ಪುಸ್ತಕ ಕ್ರಮಾಂಕ Accession No. (B)7529
Date.....

Exhibit A-3.

Note on the computations of yield of the Cauvery at Kannambadi prepared under the instructions of the Inspector-General of Irrigation (Assessor, Mysore-Madras Cauvery Arbitration), dated 20th November 1913.

1. The Assessor having accepted the Madras computations of run-off of B-3 catchment, similar computations of run-off of B-1 and B-2 catchments have, on his instructions, now been made on the following assumptions :—

The rainfall stations for B-1 catchment are Gonikoppal (Coorg) for the years 1896 to 1906 and Ponnampet (Coorg) for the years 1907 and 1908.

The rainfall stations for B-2 catchment are Hunsur and Periyapatna for the years 1902 to 1908; the records for the former are available in the Government of India rainfall statistics and for the latter the rainfall records were furnished by Mysore.

No rainfall statistics are available for Periyapatna for the years 1896 to 1901 and so Hunsur records alone have been taken for these years for computing the run-off of B-2 catchment.

2. *Statement I.*—This shows the daily rainfall for the stations of B-2 catchment for the years 1902 to 1908 and from the total rainfall thus obtained daily average has been prepared for these years.

For the remaining years 1896 to 1901 of B-2 catchment and for the years 1896 to 1908 of B-1 catchment, rainfalls have been entered in the run-off tables directly from the Government of India rainfall statistics, there being no necessity for tabulation owing to the existence of a single station for each catchment for the above periods.

3. *Statement II.*—Tables of daily net run-off into the Cauvery have been prepared for each month for B-1 catchment on the following assumptions :—

The daily run-off of B-1 catchment which is taken as an "average catchment" has been computed from Strange's tables. No deductions have been made for tank irrigation.

4. *Statement III.*—Similar tables of run-off have been prepared for B-2 catchment and a deduction of 10 per cent for a bad catchment has been made from the daily yields under Strange's figures.

5. *Statement IV.*—This shows the net run-off of B-1 and B-2 catchments after deducting 2½ per cent from the combined yield of the two catchments B-1 and B-2.

6. *Statement V.*—This is the final statement showing the daily flow past Kannambadi worked out on the following assumptions :—

Column 2 shows the total discharges in millions cubic feet over the 2 anicuts, namely, Alalkatte and Sri Ramdevar Dam (excluding channels).

Column 3 shows the net run-off from B-1 and B-2 catchments arrived at in Statement IV.

Column 4 shows the total run-off from B-3 catchment as already worked out in previous tables.

Column 5 shows the total run-off from A and B catchments (*i.e.*, columns 2+3+4).

Column 6 shows the daily deductions to be made for direct irrigation for the whole of B catchment.

7. In deducting for direct irrigation, the whole area irrigated by the Cauvery and the Hemavati below the anicuts and above Kannambadi, and the whole area under the Lakshmanathirtha basin, have been taken as detailed below :—

	Direct irrigation Acres
Cauvery below Alalkatte Anicut and above Kannambadi ...	... 11,876
Hemavati below Sri Ramdevar Dam and above Kannambadi ...	... 7,176
Lakshmanathirtha basin	... 9,166
Total	... 28,218

8. It is assumed that the irrigation commences from the 16th June every year and ends with the 15th December and deductions have been made for these periods only on the following basis:—

Table showing the daily deductions to be made from June to December for direct irrigation B-1, B-2 and B-3 catchments (28,218 acres).

Months		Acres per cusec	Total cubic feet per day per acre	Total discharge m. c.ft. per day for 28,218 acres
June ...	2nd half	30	2,880	81·3
July ...	1st half	30	2,880	81·3
	2nd half	30	2,880	81·3
August ...	1st half	30	2,880	81·3
	2nd half	40	2,160	60·9
September ...	1st half	40	2,160	60·9
	2nd half	50	1,728	48·8
October ...	1st half	50	1,728	48·8
	2nd half	50	1,728	48·8
November ...	1st half	60	1,513	42·7
	2nd half	60	1,513	42·7
December ...	1st half	70	1,235	34·8

Column 7 shows the net daily run-off past Kannambadi.

9. *Statement VI* shows the table of daily discharges at Kannambadi as per above computations.

10. *Statement VII* shows the table of half-monthly discharges past Kannambadi as calculated by Mysore and as calculated by the present methods under the directions of the Assessor.

11. The only omission in calculation made so far as is known is that no deduction has been made for "draw-off" of irrigation channels between 16th December to 15th June. This is the second crop and perennial crops season and no information is available as regards the area of these crops cultivated. The figures for these are required for completing the statements of these months, which have been abstracted at present without making any such deductions. The instructions of the Assessor on this point are to be taken. Indeed the whole question of run-off in the dry months appears to require separate consideration.

The table of "run-off" computed from B-1 and B-2 catchments in the dry season shows results altogether at variance with the yields of A catchment and frequently shows yield of this small catchment much in excess of the yield of the main river Cauvery and the Hemavati as recorded over the anicuts at Alalkatte and Sri Ramdevar.

It is suggested that the Assessor should consider the conditions of these months and pass some orders regarding the computation of yield during the dry season.

W. M. ELLIS, COL., R.E.,
Madras Representative.

Enclosure to A-3.

Reference : Colonel Ellis' note of 20th November 1913 on yield of the Cauvery at Kannambadi (last paragraph).

Statement showing the half-monthly discharges over anicuts (excluding channels) and the run-off from B-1 and B-2 catchments.

Years	December second-half		January first-half		January second-half		February first-half		February second-half		March first-half		March second-half	
	Discharge over anicuts A	Run-off from B-1 and B-2 catchments	Discharge over anicuts A	Run-off from B-1 and B-2 catchments	Discharge over anicuts A	Run-off from B-1 and B-2 catchments	Discharge over anicuts A	Run-off from B-1 and B-2 catchments	Discharge over anicuts A	Run-off from B-1 and B-2 catchments	Discharge over anicuts A	Run-off from B-1 and B-2 catchments	Discharge over anicuts A	Run-off from B-1 and B-2 catchments
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1895-1896...	...	...	3,917	...	2,857	...	593	...	461	...	484	...	317	27
1896-1897...	931	...	617	...	668	...	651	...	241	46	238	...	250	...
1897-1898...	973	...	679	..	666	...	440	...	196	...	359	...	150	..
1898-1899...	1,142	...	570	...	249	...	273	...	282	...	108	...	140	...
1899-1900...	166	...	106	...	90	...	71	...	205	...	340	...	353	...
1900-1901...	405	...	287	...	140	...	172	...	179	53	197	...	163	...
1901-1902...	1,337	...	636	...	558	...	107	...	237	34	49	...	101	38
1902-1903...	3,394	...	1,345	...	902	...	758	...	262	...	373	...	412	...
1903-1904...	2,768	...	1,647	...	1,084	...	829	...	461	...	351	...	64	37
1904-1905...	551	...	755	...	293	...	377	...	79	124	177	...	209	...
1905-1906...	819	...	596	...	*1,600* 2,534	...	318	...	52	...	*97* 107	...	*128* 116	...
1906-1907...	1,389	.	505	...	825	...	360	...	236	...	510	...	147	...
1907-1908...	1,917 *70*	...	978	...	737	...	217	...	182	...	143	...	130	...
1908-1909...	208	...	...	...	...	...	...	...	...	...	...	...	...	...
Total...	16,000 *15,862*	37	12,638 *10,569*	...	11,603	...	5,166	...	3,073	257	3,486 *3,426*	...	2,755 *2,767*	102
Average...	1,230 *1,220*	3	972 *813*	...	893	...	397	...	236	20	264 *263*	...	212 *213*	8

NOTE.—The *italic* figures show corrected totals as found on check (by Madras) of Mysore computations.

Statement showing the half-monthly discharges over anicuts (excluding channels) and the run-off from B-1 and B-2 catchments—*concld.*

Years	April first-half		April second-half		May first-half		May second-half		June first-half		Total discharge over anicuts A	Total run-off from B-1 and B-2 catchments	Average discharge over anicuts A	Average run-off from B-1 and B-2 catchments
	Discharge over anicuts A	Run-off from B-1 and B-2 catchments	Discharge over anicuts A	Run-off from B-1 and B-2 catchments	Discharge over anicuts A	Run-off from B-1 and B-2 catchments	Discharge over anicuts A	Run-off from B-1 and B-2 catchments	Discharge over anicuts A	Run-off from B-1 and B-2 catchments				
	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1895-1896...	869	...	688	92	1,003	306	1,191	23	672	285	13,252	733	2,209	122
1896-1897...	172	...	427	62	...	...	...	1,209	368	796	4,563	2,113	760	352
1897-1898...	108	...	139	146	112	346	96	126	4,152	854	8,070	1,474	1,345	246
1898-1899...	240	766	1,963	370	114	127	116	50	4,154	2,678	9,351	3,991	1,558	665
1899-1900...	283	229	260	1,528	430	...	403	263	650	1,740	3,357	3,760	559	627
1900-1901...	116	94	176	143	170	66	128	402	5,300	1,625	7,433	2,383	1,239	397
1901-1902...	220	117	179	70	236	232	264	266	3,023	3,856	6,950	4,613	1,158	769
1902-1903...	172	...	255	...	145	253	3,509	1,213	2,982	1,119	14,509	2,585	2,418	431
1903-1904...	142	140	54	132	132	334	1,407	689	5,870	851	14,809	2,183	2,468	364
1904-1905...	31	...	30	...	52	148	1,048	107	783	206	4,385	585	714	98
1905-1906...	124	...	80	...	...	486	67	20	141	34	*4,022* 4,954	546	*670* 826	90
1906-1907...	378	97	178	308	348	62	261	185	328	741	5,465	1,430	911	238
1907-1908...	76	21	486	719	953	427	324	46	211	794	6,354	2,006	1,059	334
1908-1909...	...	...	...	...	...	...	...	...	...	...	1,03,452	28,396	...	...
Total...	2,931	1,464	4,915	3,572	3,695	2,787	8,814	4,599	28,634	15,579	...	...	...	...
Average...	227	113	378	275	284	214	678	354	2,203	1,198	...	...	...	...

NOTE.—The *italic* figures show corrected totals as found on check (by Madras) of Mysore computations.

Exhibit A-3 (a).

After discussion of Colonel Ellis' note of 20th November 1913 regarding the hot weather discharges from the Kannambadi B catchment and examination of the rainfall figures, I would suggest taking a constant run-off of 30 cusecs for second-half December, January, February and March. For April, May and first-half June the volume as calculated from rainfall divided by 2.

M. NETHERSOLE,

25*th November* 1913. *Assessor, Mysore-Madras Cauvery Arbitration.*

Exhibit A-3 (b).

Remarks on the computations for finding the discharges in the B catchment.

The application of Strange's tables to find out the daily discharges can only give very rough results. The tables are meant as stated in the book in page 18 to find the gross discharge observations.

2. The rules for the classification of the statement of catchment as regards humidity are all more or less empirical and cannot evidently be expected to give reliable results.

3. From the nature of things, the rainfall is confined to a limited number of days in the year. As the computations give discharges only for such rainy days, it is clear no account is taken of the sub-soil water which mainly goes to keep up the flow in perennial streams like the Cauvery, the Hemavati and the Lakshmana-thirtha comprised in the area under question. According to this method even those rivers should show no discharges on rainless days.

4. The discharges in the B area are based on the formula:—

C = S − (I + N), where
C = net discharge into the Cauvery.
S = gross run-off as per Strange's tables.
I = water required to fill the tank ayakat.
N = water required to fill the tanks.

The formula so far as it goes is correct. But here I is taken on the assumption—

(*a*) That the whole wet cultivation in the catchment is simultaneously drawing water.

(*b*) That even at the low duties assumed (30 for June-July and first-half of August) no account has been taken of the tail water; whereas the series of tanks one below the other depend greatly on such tail water. At least one-fourth of the water in these wet months generally finds its way to the lower tanks or into the river direct. Also, the duties for tank irrigation would be much less than the figures shown above.

(*c*) The assumption that the deficit capacity of the tank (N) should be made up before there is any free flow, pre-supposes that the whole of the catchment area is fully and uniformly intercepted by the tanks. But as a matter of fact in the B-3 area alone, the unintercepted catchment is 405 square miles against 970 square miles of intercepted catchment. The drainage from the 405 square miles should be quite free. Neither the tank replenishment nor the irrigation allowance affects this area. Hence the deduction for N as if it also applied to this unintercepted area, vitiates the results.

(*d*) The source of error becomes very prominent when the value of C as computed above becomes a *minus* quantity.

5. Colonel Ellis describes the process of dealing with the *minus* results as under: "If C is a *plus* figure, the tanks will again all be full on this date. If, however, C is a *minus* figure, there will be no net run-off and the *minus* value of C will be entered in column 9, being the deficit required to fill up the tanks."

This means that the contribution from the whole area has been taken in one lot and the unintercepted area is as it were calculated to make up for the *minus* figure. This is evidently not correct. The same element of incorrectness would be applicable for the deficit factor N even when C is a positive quantity.

6. A more correct method would be to consider the intercepted area of 970 square miles quite as separate from the unintercepted area of 405 square miles. In the case of the intercepted area, the formula C=S—(I—N) would no doubt be right, but all *minus* results should be taken as zero, meaning that the area under cultivation is starved to that extent.

In the case of the unintercepted area, C would be equal to S only without any deduction factor.

7. The same remarks apply to the B-2 catchment, where also the calculations will have to be made separately for the intercepted and unintercepted areas.

8. The figures could only be scrutinised after the total discharges from the whole of the *B* catchment were received from Madras at the end of November. After finding the above sources of error, a separate set of calculations to find out the annual yield have been made for the whole of the B catchment based on the yield curves prepared by the Assessor.

Due allowance has been made for all the irrigation on a liberal basis of ·218 millions cubic feet per acre. The resulting annual discharges are compared with those arrived at by Colonel Ellis.

9. The differences vary from ½ per cent to as much as 28 per cent. Such a large variation clearly shows that the daily tables cannot be relied upon and cannot be expected to give satisfactory results when applied to the working of the reservoir, particularly as these have been under-estimated.

The total discharges as computed by Colonel Ellis may, however, be taken as giving a fair idea of the yield in the two monsoon seasons and would be serviceable for fixing tentatively the proportion between the Kannambadi and Cauvery Dam discharges.

18*th December* 1913.

KARPUR SHRINIVASRAV,
Mysore Representative.

Statement I.

Statement of gross yield from B catchment as computed by the Assessor's diagram.

Year	Rainfall in inches			Class of catchment			Run-off per square mile in m.c.ft.			Area of catchment in square miles			Yield in m.c.ft.			Gross yield from B catchment
	B-1.	B-2.	B-3.	B-1.	B-2.	B-3.	B-1.	B-2.	B-3.	B-1.	B-2.	B-3.	B-1.	B-2.	B-3.	Total
1896 ...	137·7	31·65	27·36	G	B	B	236	10	6	238	200	1,298	56,168	2,000	7,788	65,956
1897 ...	122·21	63·03	33·60	G	B	B	204	20	11	238	200	1,298	48,552	4,000	14,278	66,830
1898 ...	73·37	29·36	32·07	A	B	B	78	75	10	238	200	1,298	18,564	1,500	12,980	33,044
1899 ...	68·85	25·04	19·59	A	B	B	71	5	2·5	238	200	1,298	16,898	1,000	3,245	21,143
1900 ..	118·68	36·20	24·29	G	B	B	197·5	12·5	4	238	200	1,298	47,005	2,500	5,192	54,697
1901 ...	96·43	32·55	31·19	A	B	B	112·5	10	10	238	200	1,298	26,775	2,000	12,980	41,755
1902 ...	119·30	32·06	26·34	G	B	B	200	10	5	238	200	1,298	47,600	2,000	6,490	56,090
1903 ...	99·54	52·57	46·09	A	A	A	120	45	35	238	200	1,298	28,560	9,000	45,630	83,190
1904 ...	79·86	29·35	23·40	A	B	B	87·5	8	3·75	238	200	1,298	20,825	1,600	4,868	27,293
1905 ...	68·73	22·21	21·75	A	B	B	70	2·5	2·5	238	200	1,298	16,660	500	3,245	20,405
1906 ...	91·90	28·10	28·93	A	B	B	111	3	6	238	200	1,298	26,418	1,200	7,788	35,406
1907 ...	121·84	33·73	26·92	G	B	B	204	10	6	238	200	1,298	48,552	2,000	7,788	58,340
1908 ...	96·60	29·56	21·96	A	B	B	115	7·5	2·5	238	200	1,298	27,370	1,500	3,245	32,115

STATEMENT II.

Year	Gross yield from B catchment	Area of irrigation in B catchment	Quantity required for irrigation at ·216 m.c.ft. per acre	Net yield from B catchment	Total of Alulkatte and Sri Ramdevar Dam discharges without channels	Total yield at Kannambadi, column 5+column 6	Yield as computed by Colonel Ellis	Difference between column 7 and column 8	Percentage of column 9 to column 7
1	2	3	4	5	6	7	8	9	10
1896 ...	65,956	50,164	10,836	55,120	295,274	350,394	316,140	34,254	9·47
1897 ...	66,830	50,164	10,836	55,994	218,384	274,378	236,503	37,875	13·80
1898 ...	33,044	50,164	10,836	22,208	128,817	151,025	151,927	—902	...
1899 ...	21,143	50,164	10,836	10,307	85,864	96,171	86,102	10,069	10·47
1900 ...	54,697	50,164	10,836	43,861	277,994	321,855	247,803	74,052	28·00
1901 ...	41,755	50,164	10,836	30,919	197,454	228,373	193,034	35,339	15·47
1902 ...	56,090	50,164	10,836	45,254	186,112	231,366	191,628	39,738	17·17
1903 ...	83,190	50,164	10,836	72,354	237,599	309,953	250,273	59,680	19·25
1904 ...	27,293	50,164	10,836	16,457	170,645	187,102	186,067	1,035	0·55
1905 ...	20,405	50,164	10,836	9,569	117,305	126,874	114,089	12,785	10·00
1906 ...	35,406	50,164	10,836	24,570	155,719	180,289	159,987	20,302	11·26
1907 ...	58,340	50,164	10,836	47,504	244,761	292,265	251,583	40,682	23·9
1908 ..	32,115	50,164	10,836	21,279	166,774	188,053	166,174	21,879	11·63

Reference to position of catchment of the Cauvery Reservoir project	Reference to tank registers and maps			Area in square miles	
	Basin	Series	Sub-series	Tank catchment	Unintercepted area
B III catchment	Cauvery	Upper Cauvery	1	31·65	25·09
			2	10·62	20·26
			5	71·28	22·40
			6	18·56	23·06
			7	29·77	43·42
			11	25·95	31·22
			12	54·00	9·65
	Do	Central Cauvery... ...	2	6·68	14·92
			3	27·44	20·56
	Do	Lower Hemavati ...	1	17·61	28·66
			2	69·05	26·06
			5	175·32	16·29
			6	63·30	20·22
			7	169·45	25·04
			8	80·09	54·33
			9	127·01	24·34
				977·78	405·52

Exhibit A-4.

Note on discharges of the Cauvery and Vennar.

The directions of the Assessor as regards the figures of discharges shown in Sir J. Benton's note of 12th May 1911 were that an investigation and enquiry should be made regarding the method of computation of these discharges and the data on which such methods were based.

2. In compliance with these directions an examination of the old files relating to the annual discharge of the Cauvery and Vennar has been made, but there is nothing in these to show how the discharges prior to 1901 were computed. There is, however, discovered one curve of discharges in the Circle office file with details of method of observation and computation which was sent to the Chief Engineer for Irrigation in reply to a specific call for the same (No. 8-V of 27th April 1894).

This curve with the original papers describing the method of computation is put up.

3. A reference, however, to the daily discharges of 1893-94 and subsequent years recorded in the water registers, shows, however, that this curve is not the basis on which the discharges of these years were recorded, and that the discharges recorded are for similar rear gauge readings generally materially smaller than those in the table based on this curve.

We are left with no information as regards the basis on which the figures entered in the water registers prior to 1901 were computed.

4. In 1901-1902, velocity observations with surface floats were taken and, from the results of these, a curve was drawn and a table of discharge for rear gauge readings of the Cauvery and the Vennar was made.

This table formed the basis from which the figures in the water registers kept at the Grand Anicut were entered from 1901 to 1907. The table is the one of which a copy has been already furnished to the Assessor and to Mysore. This was in use by the Superintendent of the Grand Anicut from 1901 to 1907, and the records show that the Executive Engineer's office used it up to 1904-1905.

5. The first serious enquiry into the discharges of the Cauvery and Vennar appears to have been made in 1905-1906, when Mr. Griffith, a temporary Engineer, was deputed to enquire into the subject.

This officer took a number of velocity observations with surface floats and has written a careful report which is produced in original. The main efforts of Mr. Griffith were apparently directed to obtaining suitable figures for velocity of approach and co-efficients for the application of recognised formulæ to sluice discharges, and for confirmation he compared his results with those computed from a series of surface float observations taken the same year with a view of re-calibrating the rear gauges of both the Cauvery and Vennar.

6. It is to be regretted that the time was not rather spent on arranging for the more accurate observations of these discharges rather than the elaboration of observations regarding velocities of approach.

Mr. Griffith, however, was consistent in advocating computation by sluice discharges for the future, and as a fact this method was adopted from 1905-1906 for several years.

The Anicut Superintendent did not get any revised instructions as regards discharges, and although a revised curve of rear gauge calibration was available from 1905-1906, he continued to record discharges in his register in the table of 1901-1902 till the end of 1907.

From 1905-1906, however, the discharges in the water registers were not adopted by the Executive Engineer in compiling his returns, and sluice discharges were used for this and the succeeding year.

7. To express a personal view, I cannot think the adoption of sluice discharges was wise.

Supposing all record of sluice regulation is accurate and punctual which is rather a large expectation having in view the very large number of comparatively small shutters which are constantly being manipulated, even then, during the

frequent occasions when the discharge through the sluices is free, the calculations by formulæ are altogether abortive. Mr. Griffith's curves clearly show this although he does not admit it.

The test which Mr. Griffith applies to the accuracy of his computation is comparison with the discharge curves.

If the curves are very inaccurate, the proof is illusory.

If the curves are substantially accurate, they supply what is required without further need of investigation except in regard to general scientific investigation of the problem of sluice discharges.

8. Examination of the results of computations of the sluice discharges for the Vennar for 1906-1907 displays at once the utter unreliability of the methods adopted as applied to these regulators. It will be noticed that the elaborate formulæ for velocities of approach recommended by Mr. Griffith were abandoned and the formulæ used for computation neglected all consideration of such velocities.

Note.—Other statements of computations by sluice discharges have been wired for and are understood to be available but have so far not come to hand.

W. M. Ellis.
26-11-13.

The formulæ were :

Vents under regulation—

$D = CA\sqrt{2gh}$

$C = 0{\cdot}75.$

Vents free—

$$D = L \times C\sqrt{2gh} \times (d - \frac{2h}{3}),$$

where h = difference of water levels between front and rear gauges.
d = depth of water on lower gauge.
$C = 0{\cdot}75.$

9. The only other gaugings of the Cauvery or the Vennar which have been made were taken in 1911-1912 and the details of these are fully available.

10. A sheet has been drawn for the Cauvery and another for the Vennar showing curves deduced from the float observations of—

1893-94.
1900-01.
1905-06.
1911-12.

Observations regarding the observations and gaugings of each year are noted below.

Year 1893-1894.—Reference to the original descriptions shows that for the Cauvery the width was divided into 6 spaces and surface floats being bottles were run on 5 runs.

Instead of the discharge of each compartment being separately calculated with the observed mean velocity in that compartment, the mean of all the velocities were taken and applied to the whole cross section area of water.

The velocity was multiplied by 0·8 to reduce surface to mean velocity.

It is considered that 0·82 is a more probable figure.

Further, as current runs swifter in the deeper places, the velocity of the compartments of deeper flow have been under-estimated and those of shallow flow over-estimated with the net result that too shallow a flow will be produced.

It is believed that on the system described the results are likely to be too small by about 5 per cent.

11. *Observations of* 1900-1901 *and* 1905-1906 were taken the same way as those described for 1893-94 except that for the latter observations pieces of wood were used in place of bottles as surface floats and the co-efficient of 0·78 was applied to the average of the surface velocities to get the mean velocity in place of 0·8 applied in 1893.

The mean velocity so obtained was applied to the whole section of discharge to get the results.

12. Thus, the errors in the methods of 1893-94 were reproduced in 1901-1902 and 1905-1906 and in addition the co-efficient was taken still lower.

The minimum reasonable co-efficient is 0·82 and the true co-efficient rises gradually with depth and is probably as much as 0·85 with gauge depth of over 5 feet in the Cauvery or 7 feet in the Vennar.

It is considered that the discharges of 1901-1902 and 1905-1906 are too small by about 8 per cent on account of the above, the error being smaller for the low discharges than for the higher ones.

13. *Observations of* 1911-12.—These observations were made on a more elaborate and accurate basis than those previously described and a full account of them is forthcoming.

Bottles were used as surface floats and these were dropped at required intervals of space from a wire rope stretched across the rivers. The arrangements for dropping the bottles were those known as "the Campbell Float train." The discharges from the surface velocities were worked out by separate compartments, thus eliminating the error previously made in this matter.

An undoubted error, however, was made in reducing the surface to mean velocities by applying a co-efficient of 0·7 on the authority of Buckley.

Reference will show that Buckley's co-efficient is noted as an absolute minimum and is believed to be applicable to conditions when only the *maximum surface velocity* in a whole river and channel is considered and 0·7 of this applied to this maximum. The whole of the observations were referred back to the Executive Engineer for recomputation. They have not yet been received back.

A re-calculation has been made of the results by multiplying each by $\frac{0·82}{0·70}=1·17$ and the results are plotted on in separate curves for the Cauvery and Vennar.

14. These observations are undoubtedly the best grounded of the whole series and they tend generally to the presumption that the previous observations, of which there are records, were, although only rough approximation, not very gravely in error and that an application of a co-efficient of 0·82 to 0·83 to these curves would give mean velocities not greatly in error.

The curve of 1901-1902 is on the whole the one which gives the smallest total discharges while that of 1905-1906 gives the largest.

The other curves are more or less intermediate but more nearly in agreement to the curves of 1901-1902 than to that of 1905-1906. All the curves except that of 1911-12 make the error of applying mean velocities to the whole water section instead of computing in compartments, which induces a small *minus* error, probably some 2 or 2½ per cent.

15. The actual curves of 1901-1902 and 1905-1906 are reproduced in the papers accompanying Mr. Griffith's report and as regards the former there are many tables extant showing the curve.

The details of the actual observations have not been found but orders to search for these have been sent out. There is, however, detail, deduced from the actual velocity observations of 1900-01 and 1905-06, reproduced in Colonel Ellis' note on critical velocities of the Cauvery, No. 65-1 of 20th February 1909, which is reprinted as Appendix V, Volume II, Cauvery Reservoir Project.

It may here be explained that the actual float observations for the curve of 1901-1902 were taken in 1900.

16. The original details of the float observations were in 1909 forthcoming among the old records at the Grand Anicut and each observation with a co-efficient of 0·8 applied was re-plotted by Colonel Ellis in his critical velocity diagrams. The same was done as regards the observations of 1905 and 1906. Regarding all these, full details were then forthcoming as is recorded in Colonel Ellis' note.

17. As regards the other curve which was found, *viz.*, for the Cauvery in 1889, which was also found at that time merely a curve and plotted discharges but no

detail of float observations or velocities. It is therefore not known with regard to what basis as regards the co-efficient used the discharges were derived from.

For the purpose of recording all information forthcoming, Colonel Ellis assumed the discharges as correct and from these re-calculated mean velocities on this assumption, noting, however, that the resulting velocities must be regarded with some suspicion. It will be noticed that these velocities do not agree with those of the years 1900, 1905 or 1906, whereas all the latter agree quite well with each other. Enquiries are now being made with a view of obtaining the original records which formed the basis of Colonel Ellis' note of February 1909, but meanwhile it is submitted that the notes of Colonel Ellis and Mr. Griffith display with sufficient clearness the basis on which these discharges rest.

W. M. ELLIS, COL., R.E.,
Madras Representative.

25th November 1913.

Exhibit A-4a.

From Colonel Ellis' note of 25th November 1913 on the subject of the origin of Revenue report figures of river supplies quoted by Sir J. Benton in Appendix V (Ma. 8-a), it appears that up to 1905-1906 the figures were based on certain diagrams for the Cauvery and Vennar rear gauges, and after that date on the discharge calculated through the regulator sluices as suggested by Mr Griffith, who, in that year, was deputed to enquire into the subject. I deal with the diagrams in a separate note and here give my reasons (based on obvious errors in Mr. Griffith's results) for rejecting the method of computations of sluice discharges for years subsequent to 1905-1906.

The errors in Mr. Griffith's method of calculating the discharges through the sluices are apparent on examining his results for the Vennar discharge for 1905-1906, *e. g.*, July 12th—

	Gauges.		Discharge.	Difference.
	Front.	Rear.		
Day	8·7	7·0	10,296	+ 27 per cent.
Night	9·2	7·0	8,056	— 22 ,,

The rear gauge being in the free channel and uninfluenced by any obstruction down stream it is contrary to all experience of flow of water in open channels that the discharge should vary for the same gauge of 7·0 by so much as is here indicated in so short a period as 12 hours. I only quote this single example from Mr. Griffith's own figures but may observe that numerous similar anomalies are apparent not only in his own calculation for 1905-1906 but in those obtained from the divisional office for the information of the Arbitration Committee.

For example, taking the calculation of 1906-1907 :—

For the Vennar.

Date.			Rear gauge.	Discharge cusecs.
July	13th	D.	3·95	2,393
		N.	4·25	792
,,	14th	D.	4·35	810
		N.	4·55	2,750
,,	24th	D.	7·05	11,521
		N.	7·05	11,383
,,	30th	D.	7·75	2,864
		N.	7·75	10,025

For the Cauvery.

Date.			Rear gauge.	Discharge cusecs.
July	23rd	N.	4·55	17,789
,,	24th	D.	4·50	13,118
,,	27th	N.	4·55	14,719
,,	28th	D.	4·75	12,056
		N.	4·75	11,820
August	28th	N.	2·75	12,636
,,	29th	D.	3·35	11,559

Mr. Griffith himself gives a very sufficient practical objection to such method of calculating the discharges in his paragraph 26 (3) as follows:—

"The shutters have to be regulated constantly once in 24 hours not being sufficient to maintain fixed rear gauge readings in the rivers, *which is what is aimed at.*"

i.e., a fixed quantity of water arrived at by a fixed gauge. M.N.

"In consequence all variations in front and the heights opened are not recorded."

This, read in the light of the anomalies in the calculated discharges I have noted above, is quite sufficient to damn the method. No reliance can be placed on the discharges so calculated and they must be rejected for the purposes of this arbitration.

The only other point in Mr. Griffith's report to which I need refer is the comparison of the sectional areas as given in his paragraph 22 showing that the channels had improved after the 1902 Upper Anicut was remodelled:—

Cauvery—at 400 feet distance from regulator.

Year.	Average bed.
1900	182·85
1905	181·55

Vennar—at 400 feet distance from regulator.

1900	185·17
1908	185·08

Doubtless, as he suggests, owing to the reduction of silt brought down the Cauvery as compared to former years before the remodelling.

M. NETHERSOLE,
Assessor, Mysore-Madras Arbitration.

26*th November* 1913.

Exhibit A-4b.

After examining the Note by Colonel Ellis, dated 25th November 1913, on the various discharge diagrams used for the computations of the volumes taken into the Cauvery and Vennar channels, I consider that the 1893 diagram duly corrected in view of the known error arising from the application of mean velocity to the whole section instead of dealing with it in compartments, as also in view of the silted condition of the channels which is in evidence previous to the 1899-1902 remodelling of the Upper Anicut, and with the assistance of the 1911-1912 diagram, is the best guide we have, and I fix the following values for these gauges [*i. e.*, for the rear gauges of the Cauvery and Vennar] accordingly as in the statements attached.

Curves made out in accordance with these values should be used in recasting the estimates of quantities of water used in these channels, if either party desire to put in arguments based on these quantities before the Arbitration Committee.

M. NETHERSOLE,
Assessor, Mysore-Madras Arbitration.

26*th November* 1913.

CAUVERY.

Gauge reading.	Discharge.	Difference.
5·0	16,500	...
4·5	14,000	2,500
4·0	11,750	2,250
3·5	9,750	2,000
3·0	8,000	1,750
2·5	6,500	1,500
2·0	5,250	1,250
1·5	4,050	1,200
1·0	3,000	1,050
0·5	2,000	1,000
0·0	1,220	780
—0·5	600	620
—1·0	*Nil*	600

VENNAR.

8·0	10,000	1,250
7·5	8,750	1,150
7·0	7,600	1,100
6·5	6,500	1,000
6·0	5,500	1,000
5·5	4,500	875
5·0	3,625	825
4·5	2,800	550
4·0	2,250	400
3·5	1,850	350
3·0	1,330	520
2·5	1,020	310
2·0	790	230
1·5	550	240
1·0	310	240
0·5	125	185

Exhibit A-5.

Note by Assessor for record, dated the 29th November 1913.

After discussing the diagrams based on the Table—Appendix XIX of Ma. 13, Mysore accept as reasonable the correction suggested by Madras of the *minus* quantities shown in the corresponding Mysore Tables and incorporated in the Madras Table. I suggest that a four-day period instead of a three-day period is probably more accurate for average time of transmission and might tend to moderate the *minus* quantities.

For any fresh tables prepared the daily discharges at Kannambadi as computed under methods approved by the Assessor and dated 25th November 1913 should be used.

For arriving at an estimate of the Kabbini discharge in the hot weather months for purpose of working tables for years that Sivasamudram discharges are not available, I would suggest accepting the Sivasamudram discharges modified as follows :—

For gauges on the anicut above 0·5, the Danakere observation curve should be accepted.

For gauges below this down to zero, the Mysore calculations for anicut discharge should be taken less 12 per cent.

Kollegal sluice and extension, Mysore discharges also to be reduced by 12 per cent.

Mysore under sluice and channel discharges may be accepted.

From these data an average proportion may be determined by comparison with the Kannambadi computations.

M. NETHERSOLE,

Assessor, Mysore-Madras Arbitration.

Exhibit A-4 (c).

Further Note by Colonel Ellis on discharges of the Cauvery-Vennar below the head regulators, dated 12th December 1913.

In continuation of the note of 25th November 1913 (Exhibit A.-4) some further information has been obtained, from a search among old records made by the Executive Engineer, Cauvery Division, regarding the velocity observations and sections of discharge of the Cauvery and Vennar.

2. Sections as below have been found :—

Of the Cauvery as specified below—

For years 1888, 1889, 1890, 1891, 1896, sections taken at 400, 600 and 800 feet below the regulator.

Of the Vennar, the only old sections found are those of 1896 which are taken at 400, 600 and 800 feet below the regulator.

3. Examining the mean bed levels displayed by the sections of the Cauvery which are recorded in the attached form, it will be seen that, for the years 1888 to 1896, there is little variation in level except in the years 1890 and 1891. The details of mean bed levels are noted below :—

Year	Section at 400 feet	Section at 600 feet	Section at 800 feet
1888	182·90	182·83	182·59
1889	182·67	183·10	182·85
1890	184·15	184·04	184·23
1891	183·52	183·38	183·02
1896	182·71	182·99	183·03

The year 1890 shows a material accretion of bed level, but this has been reduced materially in 1891, while the recorded water section areas of 1893, 1894 and 1895 show that in those years the sectional water areas due to bed levels do not differ materially from those of 1888 and 1896. Cross sections at the above places are not available in the years subsequent to 1896, but reference to the tabulated bed levels, Volume II, Appendix V, Metur Cauvery Project, shows no material alteration in bed levels on those of 1896.

4. The books of discharges and float observations do not give worked out discharges except for the years 1891 to 1895, but for these years discharges are found worked out both for the Cauvery and Vennar.

These discharges are plotted in a diagram. They have been worked out on a basis of a 0·8 co-efficient applied to mean surface velocity and the result multiplied into the whole sectional area, and would probably be in consequence about 5 per cent smaller than the true discharges.

On the diagrams the curve of 1893 previously produced has been plotted as this was one of the curves on which the Assessor based his conclusions.

5. It will be seen that the discharges of the Cauvery for 1891 and 1892 are materially smaller than in other years. This, of course, results from the rise in mean bed level recorded for those years. On the other hand, for these same years the discharges of the Vennar are materially greater than in other years. Having in view the nature of the information available and the curves recorded, it appears that the curve of 1893 which has been accepted as fairly representing the period prior to 1900 is generally supported by the records now produced.

6. Two old curves of discharges of 1889 also found in the Cauvery Executive Engineer's office are also produced. These generally follow the areas of 1890 and 1891. All the records of cross sections are open to the objection that these have not been taken during the flow season but during the hot weather when the rivers are dry.

7. As regards float observations, some records of observations in the years 1905 and 1906 of which a record has now been found on examination show that the curve already produced of 1905-1906 was obtained by applying a co-efficient of 0·78 to the maximum observed surface velocity and applying this to the whole section of discharge.

This method is much inferior and also different from those of 1893 or 1900-1901 and accounts for the great difference of these curves from those of the above years.

The curve was already rejected by the Assessor.

The statement made in paragraph 11 of the original note that the curve of 1905-1906 was based on the same method of computation as that of 1893 which was understood from Mr. Griffith's report is therefore erroneous.

The records of 1900-1901 show that the curve of this year was deduced by precisely the same method as for the previous years already described in detail for 1893 and that the co-efficient used was 0·8.

8. In coming to a decision regarding discharges of the Cauvery and Vennar, the Assessor has considered that the curves of 1893 and of 1912 afforded the best basis of computation.

The further information forthcoming rather tends to confirm the applicability of the curve of 1893 to the earlier period.

9. While variation in sectional areas and velocities from year to year are observable, the general conclusions drawn from the added information now available are that there is no reason to ask for reconsideration of the conclusions come to by the Assessor on the more limited information laid before him.

W. M. ELLIS, COL., R.E.,
Madras Representative.

12th December 1913.

Comparative statement showing the average bed level and cross sectional areas of the river Cauvery below Cauvery regulator.

Year	Particulars	C.S. at 400 W. L. —188·65	C.S. at 600 W. L. —188·60	C.S. at 800 W. L. —188·55
1888	Average bed level	182·9	182·83	182·59
	Area computed for each compartment from levels given in C. S.	4,073	4,164	4,805
1889	Average bed level	182·67	183·10	182·85
	Area computed for each compartment from levels given in C. S.	4,215	4,432	4,600
1890	Average bed level	*184·15	184·04	184·23
	Area computed for each compartment from levels given in C. S.	3,243	3,408	3,526
1891	Average bed level	*183·52	183·38	183·02
	Area computed for each compartment from levels given in C. S.	3,638	3,851	4,355
1893	Area for each section due to gauge reading 4·5	4,385	4,365	4,515
1894	Do do	3,730	3,871	4,275
1895	Do do	4,053	4,205	4,244
1896	Average bed level	182·71	182·99	183·03
	Area computed for each compartment from levels given in C. S.	4,111	4,213	4,484
1900	Average bed level	182·91	*182·85	...
	Area computed for each compartment from levels given in C. S.	4,437	...	...
	Areas from manuscript statement of 9th September 1907, now found	4,266	4,604	4,043
1905	Bed level	*181·52	...	...
	Area	*5,292	...	...
1906	Bed level	...	*182·64	...
	Area	...	*4,323	...
1910	Average bed level	*184·02	...	...
	Area computed for each compartment from levels given in C. S.	3,727	...	...
1912	Average bed level	183·11	...	...
	Area computed for each compartment from levels given in C. S.	4,720	...	...

NOTE.—(1) Zero of the gauge is 184·25.

(2) To obtain M. W. L. for each section, add 4·40, 4·35 to the sections at 400, 600 and 800 feet, respectively.

* From Appendix V, Vol. II, Metur Cauvery Project report.

Exhibit A-6.

Note by Assessor, dated 3rd December 1913.

Referring to paragraph 61, Ma. 12, in which Madras state that they have been unable to trace the origin of the figures of river supplies entered by Sir John Benton

in Appendix V of his note of 12th May, I find that by referring the daily gauge readings of the Cauvery Dam, given in Volume III, Metur Project, to the Montgomerie's curve of 1881, I get the following results for the four years which I have tested :—

Years	Limit gauge applied	Figures: column 13, Appendix V, Sir John Benton's note	Figures from Montgomerie's curve applied to daily gauge Cauvery Dam	Difference
				PER CENT
1890	6·5 by rules of 1882.	143,420	144,158	0·5
1891		142,654	170,903	20
1896	7·0 by rules of 1896.	252,895	265,899	5·4
1899		129,043	118,391	8·0

Some of these differences are so small as to suggest the inference that for the total irrigation supplies from which they worked out the components, used by Sir John Benton in arriving at his totals, Madras was using either Montgomerie's curve, or modifications of it, applied in consideration of the varying conditions of the channel efficiency, as determined by periodic discharge observation. Even if it cannot now be ascertained under what rules the total discharge was split up for the purpose of the Revenue Report, it may yet be possible to trace the annual totals to their origin in the Madras Records ; and, by examination of them, to determine how far they can be relied on as evidence for the purpose of this Arbitration. I suggest that further investigation may be made on these lines if possible before the next sitting of the Arbitration Committee on the 15th instant.

M. NETHERSOLE,
Assessor, Madras-Mysore Arbitration.

No. 65-I. G., dated 3rd December 1913.

Copy forwarded to Madras for information and necessary action.

(By Order.)

M. NETHERSOLE,
Assessor, Madras-Mysore Arbitration.

Exhibit A-6 (a).

Note by the Special Superintending Engineer (Colonel Ellis), dated 4th December 1913.

Reference to the note by the Assessor of 3rd December 1913, suggesting for trial the comparing of the discharges over the Cauvery Dam on the figures of Major Montgomerie's curve with those given in Appendix V of Sir John Benton's note of 12th May 1911. This has now been done with results shown in the attached sheet.

2. It is brought to notice that it is the figures of column 10 of Sir John Benton's Appendix V and not those of column 13 which call for comparison.

3. It will be seen from the results that the figures cannot be attributed to this source.

4. Efforts are still being made to trace the figures.

W. M. ELLIS, COL., R.E.,
Special Superintending Engineer.

To the Assessor, Mysore-Madras Arbitration,
with reference to his No. 65-I. G., dated 3rd December 1913.

Statement of discharge over the Cauvery Dam taken from Major Montgomerie's curve.

Year	Period	Sir J. Benton's figures Col. 10, App. V.	Discharges over Cauvery Dam M. C. Ft.	Remarks
1	2	3	4	5
1892-93	June to January	140,184	189,358	Limited to 6·5 feet, North Gauge Cauvery Dam.
1893-94	Do	179,123	251,011	
1894-95	Do	125,500	160,046	
1895-96	Do	164,095	213,654	
1896-97	Do	227,560	252,895	Computed by Assessor.
1897-98	Do	205,990	260,449	Limited to 7·0 feet, North Gauge Cauvery Dam.
1898-99	Do	173,508	272,919	
1899-00	Do	117,312	120,271	
1900-01	Do	229,671	232,932	
1901-02	Do	204,624	261,797	
1902-03	Do	173,109	219,351	
1903-04	Do	223,146	294,653	
1904-05	Do	128,933	190,432	
1905-06	Do	165,265	137,626	
1906-07	Do	185,701	179,248	
1907-08	Do	246,777	198,588	
1908-09	Do	177,068	155,897	
	Computed by Assessor.			
1890	June to January	129,076	144,158	6·5 feet limit.
1891	Do	128,398	170,903	

Exhibit A. 7.

Extracts from records examined by Assessor.

Name of paper.	Date.	Remark.
Montgomerie's report	14th February 1881	...
Smart's revised rules	1886	... Enclosures only. The report is missing.
Hughes' Bhavani report—(a) Preliminary.	21st November 1898	... Printed.
Larminie's criticism	19th April 1899	... Manuscript.
Smart's criticism	1901	... Printed but unsigned and undated.
Hughes' Bhavani report—(b) Final ...	Do.	Do. do.
Neringipet Project	G. O. No. 971-I., dated 2nd August 1904.	
Bhavani Project report	1906	... Incomplete and not signed or dated.
Estimate for remodelling Upper Anicut..	G. O. No. 299-I., dated 22nd March 1897	Printed.
Mysore estimate for extension above Kannambadi.	5th May 1913.	Partly printed and partly manuscript.

Major Montgomerie's report of 1881. Forwarding letter, dated 14th February 1881.

(1) *Paragraph* 3 refers to Proceedings No. 1894 of 16th June 1866.
" " " 775 of 14th March 1867.
" " " 2116 of 3rd August 1870.

(2) *Paragraph* 69 of report refers to Proceedings No. 882 of 18th March 1868.

(3) *Paragraph* 4 of letter.—Maximum flood has been taken at a little more than actually passed in great flood of November 1838, *i.e.*, about 300,000 c.ft.

(4) *Paragraph* 8.—If the discharges of the Cauvery as calculated by Kutter's new formula are to be accepted, the actual water-supply of the delta is only one half of what it has hitherto been supposed to be. This subject is of equal, if not greater, importance than that of disposal of flood waters, and will no doubt receive from you the attention it deserves.

(5) *Report, paragraph 2.*—Coleroon below Grand Anicut has capacity half the maximum discharge which has to pass through the delta to the sea at any one time and is about double that through Cauvery Dam or over the Upper Anicut.

(6) *Paragraph* 6.—Mead's proposals were to prevent all ingress into delta proper below Vennar head of floods exceeding 10½ feet on Cauvery Dam.

(7) *Paragraph* 10.—Refers to large augmentation of floods in the Coleroon over and above the volume passing Upper Anicut and other surplusing works from Cauvery which augmentation had amounted to nearly 130,000 m.c.ft.

(8) *Paragraph* 12.—Refers to Colonel D. Sim's report of 16th July 1839.

(8*a*) *Paragraph* 27.—Records the maximum gauge reached during flood of November 1858, 14·4' on Cauvery Dam.

(9) *Paragraph* 36 gives his estimate of the flood abstracted as follows:—

	Cauvery. m.c.ft.	Coleroon. m.c.ft.	Total. m.c.ft.
At Cauvery Dam	135,000	149,000	284,000
At Grand Anicut including Vennar	131,000	252,500	383,500
At Lower Anicut	...	285,000	...

and goes on to show that Colonel Mead's proposal to force 131,000—50,000 m.c.ft.= 81,000 m.c.ft., into the Coleroon by excluding floods from Cauvery and Vennar, if carried out, if considered with the possible augmentation (paragraph 10), would have destroyed the Lower Anicut and devastated the country. He, therefore, considers that the reverse of Mead's proposals should be aimed at and agrees with Sim's recommendation that a large quantity of water should be thrown into Cauvery even during the highest inundations.

(10) *Paragraph* 36 states that no scheme for complete exclusion from delta proper of Cauvery floods except what is required for irrigation is either practicable or advisable and that any intermediate scheme by which any fixed portion of floods would be permanently turned down any particular channel would be only less objectionable.

(11) *Paragraph* 38 advocates very careful apportionment of floods from Upper Cauvery as between Coleroon and the Cauvery-Vennar.

(12) *Paragraphs* 39-40 strongly advocate conservance of the channels as flood outlets and quote Major Oakes in support.

(13) *Paragraph* 44 recommends rebuilding the Grand Anicut to give better control.

(14) *Paragraph* 47 sums up (I quote only important heads abbreviated)—

I. Complete exclusion of upper flood waters from the delta or from any portion of it is not practicable or advisable.

II. To fix or limit the flood discharge down any one sluice is inadvisable.

III. Flood regulation, in proper sense of the term, is imperatively necessary at Grand Anicut.

(15) *Paragraph* 61 explains why Mead's discharge calculations, Appendix A, Report, 3rd December 1866, were inaccurate: (1) he has taken uniform instead of varying co-efficients, (2) he has taken $V=9{\cdot}3\sqrt{r.s.}$ (this is evidently a printer's error and should be $\cdot 93\sqrt{r.s.}$)

(16) *Paragraph* 63.—Calculations of Cauvery Dam discharges are sufficiently near the truth to dispose of flood regulation.

(17) It would be satisfactory if they were verified by accurate gaugings: in fact for economic management of the delta irrigation it is absolutely necessary that this should be done for the lower stages of the river.

(18) *Paragraph* 68.—If calculations for lower stages of river discharge are correct, delta has only been receiving about half what has usually been thought to be the case; and that instead of the delta receiving an abundant supply of three cubic yards per hour per acre when there is 5·0' on the Cauvery Dam gauge it only receives 1½ cubic yards.

(19) *Paragraph* 69.—This would account for apparent waste of water in delta and supports Major Oakes' opinion as to the great value of the higher floods being allowed to enter: in reality the delta is not receiving a proper supply until the rivers are actually in good flood as any native of Tanjore would express it.

(20) *Paragraph* 72 refers to the effect the state of bed, *i.e.*, condition of silting, must have on control and its importance in the economic management of the irrigation.

(21) *Paragraph* 75 refers to effect, *i.e.*, the diminution of the waterway of the Cauvery at the head of Srirangam island (*i.e.*, Cauvery Dam) by which the supply of water which may enter the delta in low freshes may be somewhat diminished.

(22) *Paragraphs* 76 and 77 refer to this in detail by comparing with old section of 1833. "The Aganda Cauvery in front of the Upper Anicut has sanded up about five feet, from which accumulation, a mean depth of from two to three feet of sand is passed into the open head of Cauvery.

(23) *Paragraph* 84 ends by advocating storage to insure delta crops during any possible drought.

Colonel Smart's Rules, 1896.

(24) Colonel Smart's letter or report No. 265 of 6th May 1896 is missing--it was sent to Chief Engineer with Colonel Smart's proposed revised rules for regulator and presumably it explained at length his reasons for the proposed altering of previous rules. Chief Engineer's memorandum No. 1078-A, shows that No. 265 and its enclosures were returned to Colonel Smart for note of Chief Engineer's remarks and he was requested to return them through Superintending Engineer, V Circle; the enclosures are in the file but letter No. 265 has disappeared. I have seen current office-notes showing the letter was found to be missing in July, but it has not yet been traced.

Extracts from enclosures.

(25) Enclosure A is headed "Revised rules for distribution of water at Upper Anicut" and is clearly a preamble to the rules of 1882. It contains the following statement "from gauges at Vennar and Vettar regulators it is found that with an average gauge of 6·25′ at Cauvery Dam the Vennar and its branches receive a full theoretical supply of 2 cubic yards per cusec per acre. The required depth varies somewhat from 6·25 according to season and depth of sand at Cauvery Dam."

Colonel Smart has noted against this in margin as follows:— Extremely doubtful under present circumstances more nearly 7·0′ I think. A.W.S.

(26) 2. It is considered that with a depth of 6·5′, the Vennar will at all times receive an adequate supply.

(27) Then follow the rules of 1882 as given in Ma. 8, Appendix I (1).

(28) Then follows enclosure B in which Colonel Smart raises the limit to 7·0′. These are the rules printed as Ma. 8, Appendix I (2). His statement C shows gauges (actuals) C. Dam from 21st June to end August of 1895 and he shows that the calculated surpluses over the Upper Anicut might have been sent down the Cauvery, since on those dates large quantities of water were surplused on the Lower Anicut given in his enclosure D, *e.g.*,—

	Discharge.
June 21	44,615 cusecs.
„ 22	70,432 „
„ 23	62,428 „
„ 24	45,510 „
„ 25	31,243 „
„ 26	21,580 „
	and so on

(29) In E he shows actual rear gauges for Cauvery and Vennar.

(30) In the margin of E is the note apparently in Colonel Smart's handwriting—Cauvery F.S.L. 4·43 yards per hour per acre. Vennar F.S.L. 6·52 cubic yards per hour per acre.

(31) In Statement H which shows gauges at various points on the Vennar the Cauvery Dam F.S.L. is given as 6·5′.

(32) Table L Regulation rules show corresponding gauges which will be as nearly as possible maintained on rear of regulators at the Vennar—Vettar regulator and Table M those proposed. S is a comparative statement of Major Montgomerie's discharges with those of 1866 at Cauvery Dam.

		Montgomerie.	1866.
5·0	feet	8,150	14,340
5·6	„	12,100	19,778
6·0	„	16,500	25,200
6·6	„	21,500	31,613
7·0	„	27,230	38,010
8·0	„	39,600	52,890
9·0	„	54,200	69,900

In the margin is the note "calculated from cross section, should be checked by actual observation."

Statement T gives discharges on Cauvery and Vennar rear gauges.

(33) Discharges of Cauvery and Vennar at different depths.

Cauvery		Vennar		Remarks
Depth on rear gauge	Discharge	Depth on rear gauge	Discharge	
Feet	Cusecs	Feet	Cusecs	
0.0	1,200	0·0	...	
0·5	1,800	0·5	...	
1·0	2,500	1·0	...	
1·5	3,400	1·5	20	
2·0	4,400	2·0	110	
2·5	5,600	2·5	300	
3·0	6,900	3·0	600	
3·5	8,400	3·5	1,050	
4·0	10,000	4·0	1,650	
4·5	11,800	4·5	2,350	
5·0	13,800	5·0	3,100	
5·5	16,100	5·5	4,000	
6·0	18,400	6·0	5,050	Figures require to be checked by actual observations as conditions have altered since closing of the old Vennar head.
6·5	20,700	6·5	6,150	
7·0	23,000	7·0	7,250	
7·5	25,300	7·5	6,350	
...	.....	8·0	9,450	
...	.....	8·5	10,550	
...	.....	9·0	12,000	

A. W. SMART, LT.-COL., R.E,
Superintending Engineer on Special Duty.

6*th May* 1896.

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13. Hughes' Preliminary Bhavani Project, 21st November 1898.

(34) *Paragraph* 19.—"It will be observed that from beginning of freshes till end of August difference between supply and visible waste averaged about 44,000 millions cubic feet a month. This is almost exactly what is usually taken as full supply for the delta, allowing 2 cubic yards per hour per acre for the Vennar and 5 cubic yards for the Cauvery where the distribution is still defective. In paragraph 13, he states Vennar is fairly well provided with regulators, while Cauvery has only four.

Estimates for regulators required will shortly be submitted to Government necessary to give full control.

(35) *Paragraph* 21.—Bhavani average of twenty years varies from 20 per cent in early part to 10 per cent in middle to end. Average may be taken as 15 per cent of discharge at Cauvery Dam.

Two thousand five-hundred cubic feet is given as constant supply necessary for irrigation in Bhavani and Cauvery above Upper Anicut area 1,30,000.

(36) *Paragraph* 27.—The recently sanctioned alterations to Upper and Grand Anicuts will give a general control over Cauvery floods, but even with those works in their present condition, an immense quantity of water in excess of what is used is passed through the delta.

(37) *Appendix I* gives details of number of days Cauvery Dam gauge was over various gauges in years 1873-1897 from which I abstract the following:—

	June		July		August		September		October		November	
	5	6	6	7	6	7	6	7	5	6	5	4
Average... ...	9	5	16	11	21	10	11	4	21	13	16	8
Minimum ...	1	...	5	2	14	6	2	...	6	...	...	...
Maximum ...	23	16	31	17	31	23	30	23	31	27	30	19

(38) *Appendix II.*—Yearly discharge at Cauvery Dam May—June states that discharges are calculated from Major Montgomerie's table and that it is assumed that anything in excess of 8,300 c. ft. cannot be used.

(39) *Larminie's note, dated 19th August* 1898—5. Since construction of Cauvery-Vennar Regulators in 1887, average annual remission for eleven years ending 1896-97 is only Rs. 13,000 on a net revenue of 33,13,432 or only 30 per cent.

(40) *Mr. Larminie's report, dated 17th April* 1892, *on Mr. Hughes' preliminary report, Bhavani.*—6·0 is alluded to as the full supply required at Cauvery Dam, *e.g.*

(41) *Paragraph* 46.—There can be no doubt even in a year of average supply, there is a large excess of water in the Cauvery and Coleroon in those few days (75 in an average during seven months) when water stands over 6 ft. in Cauvery Dam and when it might be stored with advantage; in paragraph 47 he gives a table showing these surpluses.

	Number of days	Surpluses
Over 7·0	19	25,652
8·0	9	30,478
9·0	6	38,860
10·0	3	30,400
Total	37	1,25,347 m. c. ft.

and he states that his discharges over Upper Anicut are 8,700 less than Colonel Montgomerie's table gives, while those for Cauvery Dam are from the table received from the Chief Engineer's office.

(42) These figures, rough though they are, conclusively show the large amount of water which goes to waste through the Coleroon and Cauvery, the excess discharges over what is required to maintain full supply for irrigation being—

Coleroon	... 56,359
Cauvery	... 68,987
	1,25,346

and in margin is noted "This statement is not advanced as a new theory: it has of course been well known for years" and he then argues for Cauvery Reservoir which he says would admit of 6′ being maintained on the Cauvery Dam all through the irrigation season.

(43) *Colonel Smart's report* is unsigned and undated but it appears to have been written early in 1901 as it contains in appendix remarks by Colonel Smart on notes of Chief Engineer, dated July 1900 and 25th September 1900.

(44) *Paragraph* 6.—Mr. Larminie was the first to notice advisability of change of site of reservoir from Bhavani to Cauvery as he recognized that sufficient water could not be obtained from Bhavani except by reducing the recognized standard of Tanjore.

(45) 11. In Appendix I, he claims to show that in 24 years out of 25 surplus in Cauvery will suffice to give full protection to delta and also irrigate 300,000 new.

(46) *Appendix I.* 3 6′=16,500 cusecs is the recognized full theoretical supply to the delta, that is, the quantity and depth of water which after early freshes when absorption is complete gives flush irrigation throughout the delta.

(47) 7. "It is quite possible, as I have already pointed out, that before 1870 5′C.D. gave more water than it did after that date because of the gradual and slow sanding up of the Cauvery."

(48) 10. "The fact remains that 6′ C.D. is required to reach the tail ends especially in lower parts of the delta."

(49) 11. "As 6′ C.D. is the undoubted standard of Tanjore there should be no reduction in that gauge for storage and in order to prevent any loss to the irrigation above Upper Anicut and under Coleroon I have proposed that in south-west monsoon there should be no storage below 6·5′ C.D." He, however, points out that Oakes took even higher limits in July and August though Oakes also evidently considered 5·0′ permanent supply was sufficient as may be seen by the extract Smart quotes from his report.

(50) *Paragraph* 12.—The condition of irrigation in Tanjore has not altered since Oakes wrote "A number of regulators have been built on the Cauvery and Vennar and it is possible we have obtained more command with smaller gauge, but my experience is that 6′ C.D. is a minimum required from 1st July to 15th August."

(51) *Paragraph* 15.—An ideal system for Tanjore would be to maintain gauge of 6′ C.D. (in bad years when local rain fails) from 15th August to 15th October to reduce to 5′ C.D. or even less during north-east monsoon and then increase to 5′ C.D., 15th December to 31st January.

(52) *Paragraph* 16.—All excess of 5·0′ C.D. in north-east monsoon is real surplus because rains are generally more than sufficient and it is often difficult to get rid of the drainage. In bad years when local rain fails water never rises above 5′ C.D.

(53) *Appendix II* deals with absorption in June and states that from 8,000 to 10,000 millions cubic feet is lost.

Statement I, page 35

4·2 C.D.=	4,200 cusecs.	
4·8 C.D.=	7,000 ,,	
5·3 C.D.=	10,000 ,,	
5·6 C.D.=	13,000 ,,	
6·0 C.D.=	17,500 ,,	with spill into Coleroon.
	1,000 ,,	
	18,500 ,,	

These are slightly higher than Montgomerie's curve gives for these gauges.

Neringipet Project records, G.O. No. 971-1, dated 2nd September 1904.

(54) In paragraph 3, G.O. I-B No. 653 of 16th June 1900 asked for report on result of Colonel Smart's investigations while on special duty. Where is this?

Mr. Higham's note.

(55) *Paragraph* 7.—"The people have thus vested interest in supply—I infer that Government could never propose to divert any portion of the Cauvery water, when not obviously in excess of requirements from lands at present irrigated for the sake of new irrigation." "On the other hand, Government as the paramount power has an undoubted right to control distribution so long as this is done with due regard to the requirements of existing irrigation."

(56) *Paragraph* 8.—Colonel Smart proposes to satisfy the courts on this point by so arranging matters that water shall never be stored during south-west monsoon season when the Cauvery gauge registers less than 6·5′ corresponding to a

supply of about 22,000 cusecs and until after 15th August, though of course water may be stored when freshets would otherwise give more than 6¼ feet on the gauge. Colonel Smart told me that it had always been a maxim in Tanjore that the supply during freshets should be maintained at not less than 6·0′ and he considered that 6·0 (= to about 18,500) would really be sufficient but that he proposed 6½ feet so as to allow an ample margin and to render it impossible for any one successfully to contend that the supply to the delta during south-west monsoon had been prejudicially reduced for the purpose of filling the reservoir.

(57) *Paragraph* 10.—I have not been able to assure myself that it is a recognised maxim that no reduction may be made in freshets when these do not exceed 6·0 feet. It has really hitherto been impossible to effect such a reduction. He then shows that Mr. Hughes' proposal to reduce supply to 4·8′ = 7,000 cusecs was on the understanding that this would be kept constant.

"Ever since the construction of the Upper Anicut all surplus over a 6 feet gauge in the Cauvery has automatically gone to waste and it is obvious that no objection can be made to storing only such water as formerly ran to waste, which is practically what Colonel Smart proposes. It may possibly be better for the irrigator to store as proposed by Mr. Hughes giving back some of the water in times of very low supply, but it will never be so easy to satisfy objectors that the supply was not interfered with."

(58) *Paragraph* 15.—Colonel Smart's objection to Mr. Hughes' proposals to restrict gauges in early June is stated to be that 4,270 cusecs on Cauvery gauge would be practically useless for the purpose aimed at and that to get water down to lower end of delta not less than 8,000 cusecs or nearly 5·0 on gauge are required.

Gives ascertained discharge of Upper Cauvery and Bhavani channels on 11—13th December 1899 as 2,250 cusecs and whole amount withdrawn at from 3,000—4,000 cusecs.

(59) *Paragraph* 26.—The importance of improving distribution was noticed in Government of Madras No. 922 W. of 14th March 1896, and Colonel Smart was placed on special duty for two years to formulate a general scheme; such a scheme has not yet been submitted though estimates for some of the most urgent works have been sanctioned by the Government of India.

	Rs.
Improving the Upper Coleroon Anicut ...	6,57,000
Fitting lift shutters to the Grand Anicut ...	1,29,200
Constructing Puthaur, Vellappaur, Sholasudamaniar and Keerthimaniar regulators and Keerthimaniar scouring sluice	51,800
Conversion of the Cauvery Kodamurti open dam into a regulator with shutters ...	1,25,000
Altering the Cauvery Veerasholan dams into regulators and improving the Arasalar Nattar, Cauvery section ...	74,700

Paragraph 31 (*d*) and (*e*) show that Colonel Smart's report was of a most important nature specially called for by the Government of India.

Mr. Hughes' note with letter No. 7070 of 21st July 1900.

(60) *Paragraph* 5 definitely states that there was then an average of 3·0′ sand on Cauvery Dam, *i.e.*, previous to remodelling of Upper Anicut 1899-1902.

(61) It has been ascertained that Bhavani contributes 15 per cent of water passing Upper Anicut when gauge is less than 6·0′ on Cauvery Dam; regarding south-west monsoon he says "the hill catchments of Bhavani and main river are contiguous and both rivers are in a fresh about the same time."

(62) *Paragraph* 10.—Average discharge of Cauvery 1st—15th June is 2,723 millions cubic feet—was found sufficient for 70,000 to 80,000 acres of early crop; the area cultivated is but little affected when the supply is a good deal below average.

(63) *G. O. No. 762-I of 12th August 1900* called on Superintending Engineer, V Circle, to submit Colonel Smart's report called for by Government of India No. 653-C.W.I. of 16th June 1900.

(64) *Mr. Higham's note of 4th August 1901* gives following Cauvery gauge readings allowed in Bhavani and Cauvery storage schemes:—

Dates.	Limit gauges for impounding.	
	Bhavani	Cauvery.
16th—30th June	5·0 feet	...
1st July—15th October	6·0	6·5 feet
After 15th October gauges to be maintained at a minimum of	6·0	6·0
16th—30th June	4·2	...
1st—31st July	4·8	4·8
1st—31st August	5·0	4·8
1st—15th September	5·0	5·3
16th September to 15th October...	5·0	5·6
After 15th October according to demands—		

Moss's report. Appendix I to G. O. No. 971 of 2nd September 1904.

(65) Average total annual supply of Cauvery at Upper Anicut is 450,000 millions cubic feet of which 270,000 millions cubic feet for south-west and 180,000 for north-east monsoon.

(66) On page 3 reference is made to Colonel Smart's report of 1906: "Estimates and designs are mostly completed and sanctioned."

(67) Page 6 gives rules for impoundings—

	Limit gauge.
In June and before, all water in excess of discharge of 5·0′ Cauvery Dam	5·0 feet
July, August, September and first half of October	6·5
After do do	5·0
Issues so as to maintain constant supply of—	
July and August	5·0 = 8,200
1st half September	5·4 = 11,400
2nd half September and 1st half October ...	5·7 = 14,000
2nd half October and November	4·2 = 40,200 (?)
After November as per demand.	

Last Bhavani Project report unsigned and undated but apparently written in 1906.

(68) Page 8.—The estimate of Cauvery surplus based on calculations of Colonel Montgomerie and Smart.

(69) Page 7.—In calculating the figures for surplus, allowance has been made not only for existing irrigation but also for the new irrigation proposed under the Cauvery Project given on page 9 as new—

	Acres.
First crop	2,00,000
Second crop	1,60,000
Total ...	3,60,000

(70) The following minimum gauges on the Cauvery Dam have been fixed as representing the discharges necessary for old and new irrigation, all excess over these gauges being recorded as surplus.

In June and before—all water in excess of discharge on Cauvery Dam gauge of	5·0
In July, August, September to 15th October	6·5
October 16 to end of year—all in excess of	5·0

Surplus estimated after meeting above demands—

YEAR.	M. C.FT.
1890	42,147
1891	85,810
1892	123,865
1893	104,053
1894	42,891
1895	425,340
1896	425,540
1897	375,987
1898	170,776
1899	32,756

(71) Statement—page 22, gives Bhavani surpluses, 1889-1905, showing report probably written about 1906—

	M. C.FT.
Page 23 average	76,880
Worst year 1899	40,443

(72) This after making allowance for claim of Bhavani irrigation as well as for the discharges of the catchments (Bhavani and Cauvery) below the reservoir.

(73) After applying certain correction, the results are given on page 23 as follows:—

	M. C.FT.
Average 17 years, 1889 to 1905	74,322
Average 9 good years, 1892-1901	52,991
Average 4 moderate years	63,010
Average 4 bad years	43,831

(74) *Madras G. O. No. 299-I., dated 22nd March 1897.*—The estimate provides for converting the present anicut or solid weir into an open regulator fitted with moveable gates.

The conversion is desirable on three accounts.—

(1) To reduce the amount of sand now being forced down the Cauvery branch and to make the two rivers take a fairly equal share of the sand burden.

(2) To increase the flood discharge of the Coleroon and to decrease that of the Cauvery. At present in floods of over 11½ feet on the Cauvery Dam gauge, there is very considerable spill into the Coleroon over banks and cultivated land, and much damage is caused thereby.

(3) To raise the crest level of the present weir by 2 feet to allow of an increase of supply in the Cauvery during low freshes.

(75) *Note by the Chief Engineer for Irrigation on the proposed improvements of the Upper (Coleroon) Anicut, No. 62-I.—Paragraph 2.*—A depth of half a foot on the anicut gives a discharge more than sufficient for the lower Coleroon irrigation so that, when there is over 6½ feet on the Cauvery Dam gauge, water goes waste to the sea. This depth does not now give a sufficient supply to the Tanjore delta where the irrigation has greatly extended since the anicut was built. In the best of seasons the supply varies much in short periods and when the river is in freshes, more than the average supply is required to make up for previous deficiency. There are besides some parts of the delta where the lands cannot be supplied unless there is a fair amount of water in the rivers.

(76) *Extracts from Mysore records.—Mysore G. O. No. R. 6391-6424 L. R. 490-12-1 of 6th May 1913—*

(5) Three proposed extensions of existing channels—

(1) Mandagiri,
(2) Hemagiri, and
(3) Alalkatte (Chamaraj),

roughly estimated to cost 25 lakhs, proposed some years ago, can now be utilised for settling the population displaced by the Kannambadi Reservoir.

(10) Chief Engineer is requested to submit detailed estimate for these three schemes within six months.

The proposed area to be irrigated under these extensions are:—

	ACRES
Letter No. 18 of 16th January 1911—	
6 (*a*) (1) Under Mandagiri channel extension ...	7,000
6 (*b*) (3) Under Hemagiri channel extension ...	500
Last paragraph of note of 18th October 1913—	
(3) Under Chamaraj right bank channel extension ...	12,600
Total ...	20,100

Of this amount some 7,274 acres of irrigation (*vide* project report, page 25, paragraph XVI (*a*)) are to replace the areas submerged by the Kannambadi Reservoir

so that the actual extension contemplated under these schemes is about 15,136 acres.

(77) *Proceedings Madras, 3rd September 1870, No. 37—Paragraph 13*—Object of Cauvery and Vennar regulators.—Exclusion of flood-water in excess of capacity of Cauvery and Vennar from those rivers as detailed in paragraph 12 of Superintending Engineer's letter.

Superintending Engineer's letter No. 1277 of 7th February 1870, paragraph 11.—The objects of the head sluice are (1) to admit of a full supply being thrown down the Vennar (3 cubic yards per hour per acre) when there is a sufficient supply in the Cauvery above the Vennar for the lands under the Cauvery and Vennar, (2) to prevent more water entering the Cauvery and Vennar than those streams are capable of carrying with safety, and (3) when the supply in main stream falls short of the quantity required by the cultivators under both branches to admit of distribution and of full supply being thrown down either branch alternately so that water may reach the extreme limit of the delta.

Paragraph 12.—The results expected are:—

I. Prevention of breaches and consequent repairs outlay.
II. Reduced cost of maintenance.
III. Reduction of silt trouble.
IV. Reduction in amount of remissions.

With regard to III it is further explained that, in a 12·3 flood, Cauvery carries 55,190 cubic feet below Grand Anicut and it will, if regulator is built, carry only 25,830 cubic feet, thus admitting of great contraction of the bed.

The Vennar will carry 20,175 cubic feet against 27,000 in a 12·3 flood, thus admitting of contraction of bed.

M. NETHERSOLE,
Assessor, Mysore-Madras Arbitration.

18*th December* 1913.

Arbitrator's Findings on Terms of Reference 1 and 2 (a).

INTRODUCTION.

I propose to state briefly the facts which have led to this arbitration.

In 1890 a Conference took place between the Representatives of the Madras and Mysore Governments with the object of establishing a basis on which irrigation questions between the two Governments could be settled.

The Conference failed to arrive at a conclusion satisfactory to both parties.

Shortly after the Conference, the Dewan of Mysore (Sir K. Sheshadri Iyer) addressed the Resident with the object of representing the matter to the Government of India so that some definite rules should be prescribed. In his letter, he alluded to a previous dispute on the question of the utilisation of the waters of the River Cauvery between the two Governments so far back as 1807. He stated that the conditions put forward at the Conference on behalf of the Madras Government appeared to be such as would preclude all but the most insignificant works of restoration and improvement and that the restriction limits proposed were unreasonable and could not be accepted.

In a lengthy memorandum appended to his letter, the Dewan sets out his views on what he considers the natural right of Mysore to utilise the waters of natural streams. He does not attempt to define the extent of the natural right of Mysore but urges that the question as affecting the State has to be decided on the higher grounds of public welfare and general prosperity and not according to the strict rules of law applicable only to private rights.

While he is doubtful that Madras raiyats could ever acquire prescriptive rights against the Mysore State, he alleges that the user by Madras was at best only a permissive user. (I may here state that Mysore do not now adhere to this position.)

Further discussion took place between the two Governments in the course of which Mysore proposed certain rules to govern disputes relating to irrigation.

In draft rule III Mysore proposed that the existence, extent and nature of such (prescriptive) right and the mode of exercising it so as to control or limit the natural right of the Mysore State should be in every case determined in accordance with the law on the subject of prescriptive right to the use of water and in accordance with what is fair and reasonable under all the circumstances of each individual case.

Madras objected to the words "so as to control or limit the natural right of the Mysore State" and also "in accordance with the law on the subject of prescriptive right to the use of water and". Eventually Mysore agreed to the elimination of the words "so as to control or limit the natural right of the Mysore State", and Madras agreed to the retention of the words "in accordance with the law on the subject of prescriptive right, etc."

The result of the negotiations between the two Governments was the important Agreement of 1892 which will be found printed as an enclosure to Madras Exhibit 2.

So far as the present case is concerned, we need only refer to clauses III and IV of that Agreement which run as follows:—

"III. When the Mysore Government desires to construct any 'new irrigation reservoir' or any new anicut requiring the previous consent of the Madras Government under the last preceding rule, then full information regarding the proposed work shall be forwarded to the Madras Government and the consent of that Government shall be obtained previous to the actual commencement of work. The Madras Government shall be bound not to refuse such consent except for the

protection of prescriptive right already acquired and actually existing, the existence, extent and nature of such right and the mode of exercising it being in every case determined in accordance with the law on the subject of prescriptive right to use of water and in accordance with what is fair and reasonable under all the circumstances of each individual case.

"IV. Should there arise a difference of opinion between the Madras and Mysore Governments in any case in which the consent of the former is applied for under the last preceding rule, the same shall be referred to the final decision either of Arbitrators appointed by both Governments or of the Government of India."

In 1910 the Mysore Government proposed to start the construction of a reservoir at Kannambadi in Mysore territory, of a capacity of 41,500 millions cubic feet. The project was objected to by the Madras Government at first, but eventually after reference to the Government of India permission was accorded in September 1911 to build a reservoir of the capacity of about 11,000 millions cubic feet.

In the statement of the Mysore case (Exhibit My. 1) it is said "as the Mysore Government were pressed for a decision on account of the demand for power supply from the Kolar Gold Fields, they provisionally accepted the conditions laid down by Madras. But they stated that negotiations in connection with a larger reservoir would be renewed as they felt sure that sanction to the same would not be refused when the full case was submitted to the Government of India. They have accordingly commenced the construction of the reservoir with the wider foundations necessary for the full storage of 41,500 millions cubic feet."

In Madras (Exhibit 8-a) we find a record of the correspondence for the year 1911 relating to the construction of the larger reservoir. The same exhibit contains a lengthy note on the larger Mysore project by Sir John Benton, Inspector-General of Irrigation.

His final conclusions are reproduced here as it will be necessary to refer to them later on.

"*Conclusions.*—The conclusions which I have arrived at are as follows :—

(1) That the existing Madras irrigation requires the supplies of water as actually diverted over the Cauvery Dam for irrigation in the past, that no curtailment of these supplies is possible without inflicting very serious loss on the cultivators of the delta and that no reduction is compatible with the Agreement of 1892 ;

(2) That the scheme for the proposed Mysore Reservoir should be based on the surplus waters left over after operating the Madras delta irrigation system as in (1) above ; this is the proposal of the Madras Government—it appears reasonable —and the impounding rules which they propose may be accepted ;

(3) That to admit of the proposed Mysore Reservoir being successfully operated for both power and Mysore irrigation it should apparently have the additional capacities (*a*) and (*b*) below :—

	MILLS. C. FT.
(*a*) To meet shortage in dry years	13,203
(*b*) To provide for the silting up likely to occur and so that it may remain fully efficient for a sufficient period	17,770
Total extra capacity now proposed ...	30,973
Add—gross capacity proposed by Dewan	41,500
Gross capacity ...	72,473

These figures are subject to correction on receipt of the detailed project since there are apparent discrepancies in the figures hitherto reported in different papers received from Mysore ;

(4) that the surplus supplies of water available for Mysore and as intimated direct by the Madras Government are more than adequate for the additional area proposed to be irrigated in that State, provided that the requisite storage capacity—*vide* (3) above—is provided for conserving the flood waters. This result appears to me to leave the Mysore State no apparent grounds for fearing that they will not

have the means of protecting tracts which they desire to irrigate provided that they are prepared to execute the necessary works;

(5) That the proposed Madras Cauvery project is really a quite separate work from the questions now under consideration as will be seen from sub-paragraphs 1 and 2 above in which I have endeavoured to clearly explain that the Mysore Durbar are to have all the surplus supplies to which they have any claim under the existing agreement placed unconditionally at their disposal. In anticipation of any further enquiries as to how the Madras Government can hope to carry out their large reservoir under the conditions, I may briefly remark that they propose to construct an unusally large storage reservoir, to largely substitute stored water for floods thus increasing the efficiency and duty, and doubtless also to conserve many of the largest floods which could not be utilised elsewhere by any other means and which would otherwise flow waste to the ocean; in short, they are to follow the identical course which I have now urged for adoption by Mysore Durbar."

The further negotiations made it clear that it was improbable that the Governments concerned would ever reach an agreement, on the subject of the larger Mysore Reservoir. The Government of India, therefore, decided to refer the matter at issue to arbitration.

I was appointed Arbitrator and Mr. M. Nethersole, Inspector-General of Irrigation, Assessor.

The proceedings began on the 16th July 1913.

ARBITRATION PROCEEDINGS.

The Government of Madras were represented before the Arbitrator by Colonel W. M. Ellis, R.E., that of Mysore by Mr. Karpur Shrinivasrav, Officiating Secretary to the Mysore Government, Public Works Department.

Each Government proposed terms of reference which proved unacceptable to the other. Under the orders of the Government of India the framing of the terms of reference was left to the Arbitration Committee.

The Madras Government put in a brief statement of their case in which they set out reasons for refusing to assent to the Mysore project as follows:— Exhibit Ma. 1.

"I. The Government of Madras refused to assent to the project for the larger reservoir proposed by Mysore chiefly on the ground that the proposals did not provide to any adequate degree for passing down to Madras the water for Madras irrigation to which Madras is entitled by prescriptive right already acquired and actually existing. Further, Mysore have failed to afford to Madras any statement of the discharges past the dam site on which they base their water-supply computations; and in the absence of such statement with full details as to the data on which the discharges are based, Madras is unable fully to investigate the proposals or realise fully to what extent the proposals are calculated to affect Madras irrigation."

Paragraph 2 of that statement contains the claim of the Madras Government to the quantities of water necessary to conserve their prescriptive rights. It is as follows:—

"II. The proposals put forward by Madras are that the regulation of water in the working of Mysore Reservoir must be such as to give to Madras the whole flow of the river up to the quantities specified below:—

"(*a*) A discharge equivalent to the normal discharge due to a depth of seven feet of water passing over the Cauvery Dam at the Upper Anicut.

"(*b*) This discharge is to be measured on the Cauvery and its tributaries immediately above the waterspread of Kannambadi Reservoir and at a station on the Kabbini river about 40 miles above its junction with the Cauvery.

"(*c*) A right to call for an additional quantity of water not exceeding 350 millions cubic feet daily subject to a maximum in any one year of 4,000 millions cubic feet. (This claim is based on existing practice in past years.)

" (*d*) During the south-west monsoon (June to September) an additional 66 millions cubic feet daily for the supply of Veeranam tank.

" (*e*) During the south-west monsoon an allowance of 25 per cent on the flow in Mysore to be made to provide for losses in transmission between Sivasamudram and the Upper Anicut."

In paragraph 3 they state that the result of the examination of the rules proposed by Mysore for the working of their reservoir shows that the supplies which would be delivered at the Upper Anicut did not amount in quantity to what, under existing prescriptive right, Madras are entitled ; and that further under the proposed system of regulation the daily discharges at the Upper Anicut would be made to fluctuate much more than they do under existing conditions.

In the Mysore statement of the case, the demand of Madras for a 7-foot gauge limit on the Cauvery Dam was questioned and figures were adduced to show that the demand was excessive—while the other claims of Madras were challenged. Mysore also put in provisional rules for working the Mysore Reservoir.

In the reply put in by the Madras Government they adhered to their former position. In the matter of the rules for the regulation of the reservoir they strongly opposed a tentative settlement and demanded that the rules for the regulation of the reservoir and the water-supplies to be passed on to Madras should be settled now.

In the rejoinder put in by Mysore and the further reply by Madras the only point on which they were in agreement was that the records of discharges based on the gauge at the Upper Anicut (*i.e.*, the iron gauge at the northern end of the Cauvery Dam) might be accepted as reliable—*vide* My. 1, paragraph 14 and Ma. 3, Part IV in reply. The obvious reference here is to the Madras curve of 1909 for this gauge.

From the statements placed before me it appeared that the Governments concerned differed—(1) as to the extent of the prescriptive rights of Madras, (2) as to the volume of water necessary to conserve those rights, (3) as to the rules for the regulation of the proposed reservoir, and as to whether these rules should be tentative or not, and (4) whether the Mysore project was feasible, due allowance being made for the safeguarding of the rights of Madras.

The Agreement of 1892 set out above governs the relations of the two Governments in questions of irrigation from the Cauvery.

As it was possible that when it came to the stage of argument there might be some difference of opinion as to the interpretation of the Agreement itself, and as to the law of prescription, I thought it desirable to frame a separate issue as to the interpretation of the document.

After considerable discussion the following terms of reference were eventually framed:—

(1) What is the true interpretation of the Agreement of 1892?

(2) (*a*) What is the extent of the prescriptive rights of Madras against Mysore under that interpretation?

(*b*) What volume of water measured at the Upper Anicut is necessary to conserve these rights unimpaired?

(3) (*a*) What principles and rules for regulation of the discharges in connection with the Kannambadi Reservoir can best be formulated which will ensure to Madras full protection of their prescriptive rights?

(*b*) Whether the rules at first formulated should not be tentative, and, if so, for what period and to what extent?

(4) Will the construction and working of the Kannambadi Reservoir necessarily prevent the passing on to Madras of the quantity of water due to Madras?

The finding on the first term of reference will define the legal position of the parties.

Their position being ascertained, the second issue will cover all the evidence as to the nature and extent of the prescriptive rights of Madras and the finding on that issue will supply a basis on which the principles and rules for the working of the reservoir can be formulated in the finding on the third issue.

The finding on the fourth issue will depend on the findings on the foregoing issues. If that finding be in the affirmative, then it will be my duty to hold on the broad question involved in this appeal to arbitration that sanction should not be accorded to the Mysore project. If the finding be in the negative, the award will be in favour of the Mysore project.

The terms of reference were settled on the 7th August 1913, and with the mutual consent of the two parties, in order that they might be able to prepare their evidence on the issues, the proceedings were then adjourned to the 20th October. On re-opening the proceedings, further statements, replies and rejoinders were put in, from time to time, by each Government with the result that it was not until the 4th February 1914, I was in a position to consider the complete evidence in order to arrive at findings on the first and second issues.

Findings on the remaining two issues will necessarily be deferred until the Governments concerned have had an opportunity of considering the findings on the first and second issues with reference to the remaining issues.

During the course of the proceedings I received several resolutions passed at public meetings held in the Tanjore District protesting against the construction of the Mysore Reservoir and claiming on behalf of the raiyats a right to be heard before any decision is arrived at. I also received a joint representation from the standing committee of the District Conference of the Tanjore District and the Congress Committee of the Trichinopoly District to the same effect. To this representation is appended a memorandum by a retired Engineer of the Madras Public Works Department condemning the project.

The Government of Madras left it to me to decide how these resolutions, etc., were to be dealt with.

The resolutions gave expression to the apprehension of the Tanjore raiyats that the construction of the Mysore Reservoir would interfere injuriously with the delta irrigation. The lengthy representation referred to above threw no new light on the subject.

The parties before me are the Governments of Madras and Mysore. If the Madras Government considered that the Tanjore raiyats or any one else had any evidence relevant to the enquiry to produce, it was for that Government to arrange for its production before the Arbitrator. The question at issue has to be decided on the evidence produced before me by the Governments concerned, not on the evidence of persons who are no parties to the arbitration.

For these reasons I decided to simply acknowledge the receipt of the resolutions and representations.

The Government of Madras have also forwarded to me copy of a letter from the Governor of French Settlements in India asking for an assurance from the Government of Madras that the Mysore project would not aggravate the difficulties of irrigation in the French Colony at Karikal. The memorandum appended by the Madras Representative to the letter states that the requirements of the French lands irrigated by the Cauvery have been included in the statement of the amount of water claimed which has been put forward by the Government of Madras.

FINDING ON FIRST TERM OF REFERENCE.

The volume of argument on the first issue and the first part of the second issue is sufficient justification for the framing of issues intended to direct the attention of the parties concerned to the legal aspects of the case.

I find they differ first as to the interpretation to be placed on the wording of the Agreement; secondly, in their views on the law of prescription; and, thirdly, in their application of the law to the facts. The last point may more suitably be considered in the finding on the second issue.

(1) *The Wording of the Agreement.*

The parties differ as to the interpretation to be placed on the second sentence of clause III of the Agreement of 1892.

It runs as follows:—

"The Madras Government shall be bound not to refuse such consent except for the protection of prescriptive rights already acquired and actually existing, the existence, extent and nature of such right and the mode of exercising it being in every case determined in accordance with the law on the subject of prescriptive right to the use of water and in accordance with what is fair and reasonable under all the circumstances of each case."

The interpretation which the Madras Government would put upon this sentence is set out in paragraph 7 of Madras Exhibit No. 7 as follows:—

"Some of the Mysore arguments suggest that the extent of the prescriptive rights of Madras must be decided on the basis of what is 'fair and reasonable.' This cannot be admitted. On a proper reading of clause III of the Agreement, the words 'fair and reasonable' have reference evidently to the expression 'mode of exercising (the prescriptive right)', and this question comes up for the consideration of the Arbitrator only in so far as it may be necessary for the Arbitrator to see whether the protection of what he may find to be the prescriptive rights of Madras in accordance with the law on the subject necessarily requires that consent should not be given to the Mysore work; it is open to him to say that on a reasonable way of exercise of its rights by Madras such rights will not be affected by a work proposed by Mysore. It would be meaningless to suggest that a question should be determined both in accordance with law and in accordance with notions of what is fair and reasonable. What is to happen if the two criteria differ? The only sensible way of construing the last sentence of the third clause is to apply the two criteria respectively to the two points to be determined and to hold that the *existence, extent and nature of the right* should be determined in accordance with law and the mode of exercising the right (as ascertained) is to be fixed in accordance with what is *fair and reasonable.* It is clear from draft issue 2 attached to the Mysore Memorandum (My. 1) that Mysore also understood the clause in this sense."

Paragraph 9 of My. 6 sets out the views of the Mysore Government on the interpretation of this clause:—

"The observations in paragraph 7 about the meaning of the terms in rule III of the Agreement of 1892 put a strained construction on the passage which Mysore do not accept. Even in deciding the exact meaning of an agreement, and in interpreting law, what is fair and reasonable cannot be disregarded.

The contention of Mysore is that the extent of the prescriptive rights of Madras must be decided on the bases of—(1) the law of prescription and (2) what is fair and reasonable. Both these are laid down in clause III of the Agreement of 1892, and there is no warrant for arbitrarily distributing the two parts of the expression, namely,—

"being in every case determined in accordance with the law on the subject of prescriptive right to use of water and in accordance with what is fair and reasonable under all the circumstances of each individual case,"

"the existence, extent and nature of such right" and "and the mode of exercising it."

Such an interpretation is opposed to the ordinary rules of grammatical construction, and the framers would easily have used more suitable phraseology, if their meaning was what the Madras case suggests. It is further most important to remember that the question of the extent of a right is one of *mixed law and fact*, the province of each of them being separate. The test of "what is fair and reasonable" has to be applied in determining the question of fact on which the extent of the prescriptive right depends and this can be done without coming into conflict with law. Hence the question raised in paragraph 7 by Madras "what is to happen if the two criteria differ" need not be seriously considered".

To which Madras replied in paragraph 4 of Ma. 11 as follows:—

"As to the significance of expression 'fair and reasonable' in rule III of the Agreement, the Madras Government certainly do not wish to minimise it much less to ignore it. Nor did they ever object to what may be called 'a fair and reasonable' application of the law. But it is not easy to see how the theory of 'fair and reasonable' is to be woven into the law of prescription. On the other

hand, it is much more difficult to detect any element of either fairness or reasonableness in the contention of Mysore (in paragraph 16 of the memorandum) that the improvements made in the Upper Anicut in 1899-1902, *with a view to better utilise the water available*, involve the consequence that pre-existing rights of water must be regarded as *abandoned*. The construction of compound clauses by reading the expressions *distributively* is not unknown to the law of interpretation and certainly not unnatural. The Madras Government do not deny that the facts must first be found before the law of prescription can be applied, but that is a matter of evidence as to intention and use and not one to be determined by any external standards of 'fairness' or 'reasonableness.' But whatever may be the effect to be attached to the expression 'fair and reasonable' in rule III, it is certainly impossible to put on that rule the construction contended for by Mysore (in the last sentence of paragraph 5) that it is *for the Arbitration Committee to devise* a method by which Mysore can freely exercise its rights."

In the further statements put in by the parties they each adhered to their original positions.

As a general rule, the grammatical construction of a sentence must be given effect to, unless, from the context and the sentence itself, it is clear that the meaning of the sentence is other than appears from the grammatical construction.

See Maxwell on statutes, page 4—

"The great fundamental principle is—

In constructing wills, and, indeed, statutes and all written instruments, the grammatical and ordinary sense of the words is to be adhered to unless that would lead to absurdity or some repugnance or inconsistency with the rest of the instrument; in which case the grammatical and ordinary sense of the words may be modified so as to avoid that absurdity, repugnancy or inconsistency and no further."

"When once the meaning is plain, it is not the province of the court to scan its wisdom or its policy", page 6.

See also Tagore Law Lectures for 1909 on the Interpretation of Deeds, Wills and Statutes in British India, pages 3, 5 and 23.

In the sentence under consideration, there is no reason why the words "fair and reasonable" should not be predicated of the "nature and extent" of the right acquired by Madras. The intention of the parties to the Agreement clearly was that Mysore should be permitted to improve their irrigation system provided such improvement did not affect injuriously the existing Madras rights to utilise the waters of the Cauvery. It was agreed that such Madras rights must, in its nature and extent, be fair and reasonable. Otherwise Madras might demand for irrigation purposes a quantity of water much larger than was actually required.

It is true that the words "fair and reasonable" cannot be predicated of the "existence" of a right, but it appears to me that the sentence must be read as a whole, and that the meaning to be assigned to it must be as indicated above. With reference to the argument that the proposition that a prescriptive right is to be measured with reference to an imaginary standard of fairness cannot but sound strange, I need only observe that instances where law and equity conflict are not of rare occurrence. Further, it was within the competence of the parties to contract that their relations should be governed not alone by law but by considerations of equity. Such, in my opinion, was the intention of the parties which finds expression in clause III of the Agreement. I am, therefore, of opinion that the Madras views as to the interpretation of the Agreement cannot be upheld.

(2) *The Law applicable.*

The parties to the Agreement covenanted that the existence, nature and extent of the Madras right of prescription should in every case be determined in accordance with the law on the subject of prescriptive right to use of water. I omit, for the present, consideration of the "fair and reasonable" condition in the agreement. They do not proceed to say what law is to be applied, whether the English law, or the Indian law which finds place in the Indian Limitation Act, and the law of

Easements. The position taken up by the Madras Government is set out in paragraph 12 of Ma. 7.

"Having regard to the fact that the two parties to the contract were not private individuals, but two neighbouring States, the law referred to could not possibly be any statutory enactment obtaining in British India or England. So far as Mysore is concerned, it is believed that there was no statute in force in 1892 dealing with the subject of Easements and that there is none even at the present moment. Even in British India, the Easements Act is not in force in all the provinces. The law intended to be applied could not possibly be a municipal law of limited applicability in the territories of one only of the two contracting powers. It could, therefore, only refer to the principles of international law and the principles of the English common law in so far as they might by their generality and intrinsic reasonableness commend themselves for acceptance in inter-State dealings. This is the reason why, in paragraph 6 (*a*) and (*b*) of his memorandum of 1890, Sir K. Sheshadri Iyer felt himself obliged to appeal to international law. The principles invoked by him, however, have no foundation in that body of law."

Mysore contend that the Indian law is applicable on the ground that the Indian Limitation Act had been in force both in Madras and Mysore since 1871, and it should be presumed that the provision in section 26 of that Act was present to the minds of the parties to the Agreement.

In the further discussion of this question, Madras stated in paragraph 3 of Ma. 14 that "the question of the particular kind of prescription that the authors of the Agreement had in view deserves no further discussion, as it is of little significance in the present circumstances and it is common ground that the principles both of the law of prescription and of the law of easements can apply here not in their entirety but only by way of analogy so far as there is reasonable ground for such analogy."

In the absence of any clear specification of the law which the parties intended should be applied for the ascertainment of the Madras prescriptive rights, it should, I think, be presumed that the parties had in mind the general principles common to both English and Indian Law; where English and Indian law differed on any point, the Indian law should be followed, as being more likely to be present to the minds of the contracting parties.

The one point on which they are in agreement is that the period necessary for the acquisition of a prescriptive right is twenty years.

In the present case the reason why the Mysore Government lay emphasis on sections 26 and 27 of the Limitation Act is apparent. Under the Indian Law it is necessary for the acquisition of any prescriptive right that it should have continued to within two years of suit. Mysore under that interpretation of the law would contend that Madras would lose any right to use of water which Madras had failed to exercise within two years of 1910, the year in which the dispute between the two Governments began.

Madras have, roughly speaking, some 1,200,000 acres under irrigation from the Cauvery. If the Mysore contention were given effect to, it would follow that Madras would have to prove that the irrigation from the Cauvery of every particular holding comprised in that area had been peaceably and openly enjoyed (by the Madras Government) claiming title thereto as an easement and as of right without interruption and for 20 years. Such an interpretation would place the Madras Government at the mercy of the variableness of the seasons, and I have no hesitation in holding that such an interpretation was not within the contemplation of the parties to the Agreement.

The relations between the parties are governed not merely by the law of prescription but by consideration of what is "fair and reasonable." In my opinion it is not "fair and reasonable" to make the area actually under irrigation during the period of prescription the sole measure of the rights of Madras. There are other considerations, such as, quantities of water required for purposes connected with the operation of works and regulation, such for example as water for scour and necessary levels to ensure command, which must also be considered a fair and reasonable application of the 1892 Agreement.

In the course of the arguments I have been referred by the parties to a number of statutory provisions and rulings bearing on the law of prescription. These provisions and rulings deal generally with the acquisition and mode of user of prescriptive rights and how they may be lost by discontinuance, abandonment, etc.

A point which has been overlooked by both parties requires some consideration. The relations between the parties as to irrigation matters before the Agreement of 1892 came into force were not, so far as I am aware, the subject of any treaty between the two Governments and neither party has quoted any authoritative statements of international law on the respective rights of States to water of a river flowing through both their territories.

As the parties refer in the Agreement to the ordinary law of prescription, it is desirable to enquire what were the rights of the parties before the Agreement of 1892, assuming that the ordinary law of prescription would govern those rights. Mysore was in the position of an upper riparian, Madras, in that of a lower riparian, owner. In the illustrations to section 7 of the Easements Act the rights of upper and lower riparian proprietors are set out as follows :—

"(*j*) The right of every owner of land abutting on a natural stream . . . . . to use and consume the water for drinking, household purposes and watering his cattle and sheep, and the right of every such owner to use and consume the water for irrigating such land and for the purposes of any manufactory situate therein, provided that he does not thereby cause material injury to other like owners.

"(*h*) The right of every owner of land that the water of every natural stream which passes by, through or over his land in a defined natural channel shall be allowed by other persons to flow within such owner's limits without interruptions, and without material alteration in quantity, direction, force or temperature."

These rights are commonly referred to in text-books as natural rights and easements or restrictions of such and similar rights.

The observations of the Judicial Committee on the law of riparian rights may also be quoted. (*Debi Pershad* v. *Joynath Singh*, *I. L. R.*, *24 Cal.*, *865*): "The right claimed by the appellants is a right on the part of an upper proprietor to dam back a river running through his land and to impound as much of its water as he may find convenient for the purposes of irrigating, leaving only the surplus, if any, for the use of proprietors below. In the absence of a right acquired by contract with the lower heritors or by prescriptive use the law concedes no such right. The common law right of a proprietor in the position of the appellants is to take and to use, for the purpose of irrigation, so much only of the water of the stream as can be abstracted without materially diminishing the quantity which is allowed to descend for the use of riparian proprietors below and without impairing its quality. What quantity of water can be abstracted and consumed without infringing that essential condition must in all cases be a question of circumstances depending mainly upon the size of the river or the stream and the proportion which the water abstracted bears to its entire volume . . . . The legal right of the lower riparian owners is to have the waters of the stream transmitted to them continuously and without interruption and without any substantial diminution in volume, their right being only subject to the qualification that an upper proprietor may, for purposes which the law regards as legitimate, withdraw from the stream as it passes along his land so much of its stream as will not materially affect its downward flow or impair their use of it."

The decision in "*Embrey* v. *Owen* (*6 Exch. 353*)" on the same subject is also pertinent.

It thus appears that (assuming, of course, ordinary municipal law to be applicable) before the Agreement, Madras would have had a natural right to the flow of the Cauvery without interruption and without material alteration in quantity, while the right of Mysore except as regards rights already acquired in matters of irrigation was hedged in with the proviso that no material injury should be caused to Madras.

Mysore could only acquire rights in excess of such natural right, either by grant or by acquisition as a right of easement. Madras had no necessity to acquire rights by prescription inasmuch as the right enjoyed by Madras was a natural right. The effect of the Agreement of 1892 was to place upon Madras the burden of acquisition by prescription of rights, which, but for the Agreement, and assuming the parties to be governed by ordinary rules of law, would have been their natural right. Therein lies the difficulty of applying to the parties the law as laid down in statutes, text-books and law reports. The law and the legal decisions on the question of the acquisition by prescription of rights by easement to irrigation deal with the acquisition of such rights by upper riparian owners as against lower. I have not been referred to any decision on all fours with the present case where the lower riparian owner is called on to prove the acquisition of prescriptive rights against the upper riparian owner.

Whatever may have been the ideas of the parties to the Agreement as to the law of riparian owners, it was settled under the Agreement that Madras were entitled to such rights as it had acquired by prescription and as were fair and reasonable. As said above, the period of 20 years is admitted by the parties here as the period requisite to give a title by prescription.

As to the terminus *a quo*, Mysore would fix 1890 as the starting point of limitation while Madras contend that the Mysore representation leaves out of consideration rights which had matured both prior to 1890 and between 1890 and 1910.

It is needless to reproduce here the arguments on the subject. It is sufficient to say that I am satisfied generally for the reasons advanced by the Madras Government that the view of that Government is correct.

As indicated above, I do not consider it necessary that Madras should prove continuous and uninterrupted enjoyment for every year. This point will be dealt with further in my finding on the second issue.

The Mysore Government have advanced arguments with special reference to the effect of the remodelling of the Upper Anicut in 1899 to 1902 to show that Madras had lost certain rights by abandonment or non-user. Such arguments depend for their validity on proof of the intention to abandon a right already acquired.

There is no evidence before me of any intention on the part of Madras to abandon any right once acquired. The object which Madras had in view in remodelling the Upper Anicut was quite compatible with the intention to retain any rights already acquired; though the question whether the nature and extent of such rights are fair and reasonable, is a matter which, under the Agreement, requires full consideration.

In discussing the "legal principles in determining the extent of prescriptive right", Madras in Ma. 7, paragraph 32, state "it is no doubt generally laid down in the authorities that the measure of a prescriptive right is the extent of user and we do not dispute this as a general proposition. But it is not a complete statement and the question still remains how is the extent of the user to be measured ....." The true principle is indicated in section 28 of the Easements Act which provides that the extent of any easement and the mode of its enjoyment must be fixed with reference to the probable intention of the parties and the purpose for which the right was acquired, and it is only in the absence of the evidence as to such intention and purpose that it is provided that the extent and mode of enjoyment must be determined by the accustomed user of the right. The evidence as to intention and purpose may be direct or circumstantial. The following statement in Mr. Doss' Tagore Lectures on Riparian Rights, page 324, may be taken as correctly summarising the law:—

"Where water rights are acquired by prescription, their extent must be determined by the accustomed user, that is to say, the user upon which such right is grounded; but this must not be understood to imply that the riparian owner who has acquired the right is bound to use the water in the same precise manner and to the same precise extent or apply to the same mill, that he must not enlarge the area under cultivation or change the mode of it or enlarge the dimensions of the wheels or the horse-power of his machinery or change the site of his mill,

for that would really prevent the growth of agriculture and stop all improvements in machinery. The principal rule is that he may change the mode, the object and even the place of using the water, provided the variation thereby effected is not so material as to sensibly prejudice the rights of other riparian proprietors. A difficulty may, however, arise if the user has been varying in extent. It has been held that in such cases the court is not bound to found its judgment solely upon the actual user proved, but may also take into consideration the surrounding circumstances."

The following statements of the law taken from Angell on Watercourses may also be taken as authoritative :—

"The extent of the presumed right is determined by the user on which is grounded the presumed grant, the right granted being commensurate with the right enjoyed," paragraph 224; "The extent of the right is to be measured and regulated by the enjoyment upon which the right is founded," paragraph 226.

In applying these propositions of law the important distinction must be borne in mind between water used for purposes of power, *e.g.*, for working a mill, and water used for purposes of irrigation. In the former case the water so used is returned to the stream without diminution of quantity. In the latter case the water used is absorbed into the soil, and the quantity which a riparian owner is entitled to use for irrigation purposes is regulated by customary user. It is only with this aspect of the law or what constitutes reasonable use that we are concerned here. In the case of irrigation and certainly in this case the "use" must be beneficial use and must not include waste.

Madras indicate the meanings they attach to "user" by quoting the explanation of the expression "beneficial enjoyment" in the Easements Act. "The expression 'beneficial enjoyment' includes also possible convenience, remote advantage or even a mere amenity."

This wide interpretation conflicts with the condition in the Agreement that the nature and extent of the right and the mode of user shall be fair and reasonable, and this being the case, the Agreement must prevail.

See Swindon Water Co. *v.* Wilts and Berkshire Canal, L. R., 7 H. L., 697, and the Law of Waters by Coulson and Forbes, page 140 *et seq.*

As a matter of law the user must be a reasonable one. What constitutes reasonable user depends on the circumstances of each particular case.

Not only does the law lay down that the user must be a reasonable one, but the Agreement itself provides that the prescriptive rights of Madras must be fair and reasonable in nature and extent.

In coming to a finding on the second issue, I shall have to apply the doctrine of reasonable use as well as the "fair and reasonable" condition in the Agreement to the facts as proved.

When any matter is open to doubt, the benefit of such doubt will be given to Madras in view of the actually existent and extensive interests of Madras in the Delta irrigation as compared with the prospective and relatively unimportant interests of Mysore, affected by the Mysore project.

SECOND TERM OF REFERENCE.

"2. (*a*) What is the extent of the prescriptive rights of Madras as against Mysore under that interpretation ?"

In my finding on the first term of reference I held that it was not within the contemplation of the parties to the Agreement that Madras should be bound to prove the uninterrupted enjoyment of irrigation facilities for a period of twenty years by each particular holding comprised in the 1,200,000 acres of Madras lands irrigated from the Cauvery. It was not the intention of the parties to the aribitration that the Committee should go into such detail as an inquiry into the separate user by each holding would necessitate. The area of the land irrigated is no doubt an important factor in estimating the quantity of water actually used by Madras. But in addition to the water actually placed upon the land, water has

been also needed for the purposes of scour so as to prevent the silting up of the channels and may still be necessary, while a further supply might conceivably be necessary to maintain water in the channels at an efficient level for irrigation purposes.

Speaking generally, it may be said that Madras are entitled to that quantity of water for irrigation purposes which was from time to time used in the past and which, but for local and seasonal causes, might have been used uninterruptedly for a period of twenty years. In other words, Madras subject to physical limitations are entitled to have at their command a full supply for all their irrigation requirements whether in any particular year that full supply is actually expended or not.

This general statement of the right of Madras is of course subject to the qualification that both quantity and use must be fair and reasonable; and what is a fair and reasonable quantity, which has been actually used by Madras, has to be decided on the facts and figures placed before the Committee.

The evidence as to the quantity to which Madras is entitled will be dealt with more appropriately under the second part of this term of reference.

The parties are agreed that the gauge readings at the northern end of the Cauvery Dam are reliable.

My finding on the first part of the second term of reference can only be expressed in general terms, *viz.*, that the extent of the prescriptive right of Madras may be measured by that gauge reading at the Cauvery Dam (Upper Anicut) which connotes a full and ample supply for the reasonable requirements of Madras irrigation according to the season.

Assessor's Examination of Evidence.

PART I.

Preliminary.

General description.

The map of the Cauvery river basin, Appendix A.E. I., illustrates important points which came under consideration in this Arbitration. As will be seen, the main Cauvery river rises in the Coorg hills and shortly crosses the Mysore western boundary. In its course through that State it receives confluents from several tributaries the most important of which is the Kabbini. It crosses the Mysore eastern boundary near Kollegal and thereafter for some 40 miles, it becomes the boundary between Mysore and Madras territory. It then leaves the Mysore boundary and flows for some 170 miles through Madras territory as far as the Upper Anicut at which point its supplies are distributed to the Tanjore delta the existing irrigation of which constitutes the most important claim which Madras has on its waters. In its course through Madras it receives confluent supplies from several other tributaries, the chief of which is the Bhavani.

2. The Arbitration has arisen from a demand made by the Mysore Government under the Agreement entered into by them with the Madras Government in the year 1892 for permission to construct a large storage reservoir at Kannambadi shown in the north-east corner of the map; and from the opposition offered to that demand by Madras under the same Agreement on the grounds that the reservoir as projected by Mysore would threaten their prescriptive rights and important interests vested in the existing Cauvery delta irrigation coloured green in the south-east corner of the map.

3. The Cauvery delta irrigation supplies depend chiefly on the catchment area above the Upper Anicut where supplies first come under regulation for distribution as between the Cauvery and Coleroon rivers by the Madras works constructed for that purpose. It is here that the Cauvery dam gauge, which is of extreme importance in this Arbitration, is situated.

4. The catchment area is sub-divided on the map as between the more important confluent tributaries of the Cauvery river. The part of the catchment lying in the hills to the west is by far the most important contributor to the river supplies during the south-west monsoon which again yields the most important share of the total annual rainfall affecting the river supplies. The north-east monsoon chiefly affects the eastern part of the catchment.

5. It will be seen that the proposed Mysore reservoir would intercept but a small proportion of the whole catchment and the following classification of the catchment area in round figures will be of interest:—

	Catchment above Delta	Catchment above Kannambadi	Percentage column (2) of column (1)
	SQ. MILES	SQ. MILES	PER CENT
Hills	4,350	1,880	43
Plains	21,800	2,220	10
Total ...	26,150	4,100	16

In the Metur Project, Volume I, the sub-division of the catchment area as it is influenced by the south-west monsoon and north-east monsoon, respectively, is given in round figures as for the south-west 16,000 square miles and for the north-east 10,000 square miles; the former of course includes the 4,350 square miles of hill catchment.

6. After the primary regulation of the river supplies at the Upper Anicut, they are further controlled by the Madras works known as the Cauvery and Vennar

regulators combined with the Grand Anicut which distribute irrigation supplies as between the Cauvery and Vennar systems and also admit of flood regulation as between those rivers and the Coleroon. Irrigation supplies in the Coleroon are distributed at the Lower Anicut. The rules framed from time to time for the regulation of the irrigation supplies at these various points and the operation of those rules in the past form a most important part of the evidence put before the Arbitrator in support of the respective claims advanced by either party to the Arbitration.

7. The Delta irrigation area below the Upper Anicut amounts in round figures to about 1,020,000* acres; it is coloured green in the map; and there is also some 27,000 acres of irrigation in the French territory shown hatched in the map in the neighbourhood of Karikal. There is no evidence before the Arbitrator as to any works for the control of irrigation supply in the French territory; but it is clear that this has always received its supply from surpluses from the Madras works on the Cauvery system and will continue to do so in future. And always provided that the supplies enjoyed by Madras in the past and passed into their Cauvery system at the Cauvery and Vennar regulators are secured to them in future, there is obviously no reason to suppose that the necessary supplies to the French territory enjoyed by them in the past will in any way suffer.

*Note.—This figure is taken from diagram Ma. 9; the area given in Ma. 8, paragraph 13, is 1,002,000 acres.

8. A reference to past records of the Delta irrigation both of the Cauvery and Coleroon systems—*vide* diagram Ma. 9—shows very clearly that full development up to the capacity of the existing works has been reached, the best period in point of area being that from 1882 to 1892, and that no further development can be looked for or is expected on the systems as they stand to-day or as they existed at that period.

9. It is in evidence, however, that Madras recognising this and also that the present systems and works are not circumstanced to make use of the whole of the river supplies believed to be available, formulated a project for a large storage reservoir to be constructed at Metur (shown about the centre of the map), which had for its object the storage of part of the river surpluses believed to be available and the irrigation of some 350,000 acres of new irrigation shown in red in the south-east corner of the map adjoining the existing Delta irrigation.

10. Another point of importance to the present Arbitration is the existing Hydro-Electric Power Installation at Sivasamudram constructed by Mysore about the year 1902 and to extend which is one of the objects of their proposed reservoir at Kannambadi.

11. Both above Sivasamudram in Mysore territory and between Bhavani and the Upper Anicut in British territory, there are certain minor irrigation systems dependent for their supply on the Cauvery river both in the monsoon or wet seasons and also in the hot weather or dry seasons and points connected with prescriptive rights in these channels have arisen during the Arbitration proceedings which also have to be considered.

12. I need only say here with regard to these minor Madras systems that statistics as to their irrigation which have come under notice of the Arbitration Committee do not appear to warrant the same conclusion as to their full development having been already attained as do the records of the Delta irrigation, as I have already noted with regard to that in paragraph 8.

13. Finally, I may notice in this general description that the run-off of a very large proportion of the Mysore plains catchment is already and has for many years been intercepted by a very complete system of storage tanks of great antiquity.

14. A very important point for examination, since it must be the basis of all estimates of the quantities of water used by Madras in the past, and, under their prescriptive right, due to them in future, as well as of the quantities surplused and available in whole or in part for storage, is the Cauvery Dam discharge diagram, to be found in the pocket of Volume III of the Madras Cauvery Reservoir Project.

River discharges at Cauvery Dam.

15. Two curves are given of discharges in cusecs for different readings on the Cauvery Dam gauge; one laid down by Major Montgomerie in 1881, and the other by the special officer in charge of the Madras Cauvery Reservoir Project; the latter is based on gaugings specially conducted for the purpose in 1909.

It will be seen that these curves cross each other at about the gauge of 6·75, Major Montgomerie's curve giving discharges less than those of the 1909 curve for gauges lower than 6·75, and more for gauges higher.

16. I have taken out discharges for both curves for all gauges by decimals of a foot from zero to 7·0 and compared them in Appendix A.E. II to this note; supplies up to certain gauge limits compare as follows:—

For gauges.	Montgomerie's curve.	Madras curve.
0 to 5·0′	100	220
0 to 6·5′	100	148
0 to 7·0′	100	134

proving beyond all question that the estimate of quantities of water used in past years by Madras for their delta irrigation, based on the daily gauge records, must vary very considerably according to which of these curves is used.

17. This matter, as it affects the claims of either party to a supply connoted by a limit gauge under the rules of regulation and the estimates of supplies actually used in the past, obviously requires most careful consideration. For gauge readings up to 7·0′ and for the channel in its present state the 1909 curve may be accepted as correct; it will be seen to lie as fairly as is possible to locate it with reference to the observed discharges based on mean velocities.

18. Above 7·0′, however, it appears to me to be somewhat doubtful; it lies more generally below the recorded observations based on mean velocities.

19. In Appendix A.E. III, I have plotted the Madras 1909 curve to a smaller scale—*vide* the firm line on the diagram—and it will be seen that from about 7·0′ it does not conform to the more or less regular parabolic trace which such curves generally follow; and I have drawn the dotted line which appears to be a probably more correct curve for gauges from 7·0′ to 9·0′.

20. In Appendix A.E. IV, I have plotted differences in million cubic feet as read from the curve in Appendix A.E. III for gauges from 7·0′ to 9·0′ and have continued it to 14·0′, the maximum gauge recorded, showing an addition at that gauge of 4,000 mills. c.ft. = 46,000 cusecs: this agrees very closely with the difference (313,000—266,000) = 47,000 c.ft. which, as explained in paragraph 74, Volume I, Madras Cauvery Reservoir Project, the 1909 curve gives below the generally accepted record of the maximum flood of July 31st, 1896.

21. The foregoing examination tends to confirm the opinion recorded in paragraph 74, Volume I, Madras Cauvery Reservoir Project, that the 1909 curve was probably too low for floods higher than moderate.

22. In Appendix A.E. V, I have tabulated the differences as read from the curve Appendix A.E. IV and applied them to the Madras estimates of river discharge above 7·0′ as given in the working tables Volume III of the Madras Cauvery Reservoir Project; the results are given in Appendix A.E. VI and I think it very probable that even these are still somewhat low for the higher gauges.

23. This correction of the estimates of total river discharges can only affect the Arbitration in so far as it may affect the quantities surplused, and, in whole or in part available for storage.

In years of low supply the effect is not great, *e.g.*—

Year.	Increase Mills. c.ft.
1894	6,310
1899	6,780
1905	6,134

but in other years the increases are considerable and the average annual discharge is raised from 425,000 to 450,000, an increase of 5·8 per cent.

24. This amendment, it is to be noted, only affects discharges over 7·0′ and I leave for fuller discussion later the question as to how far the curve below 7·0′ may

be accepted as a basis for the estimates of quantities of water aimed at in the rules and regulation or actually used in the past for irrigation in the Delta.

Yield from the catchment.

25. In the foregoing paragraphs 19-23, I have given my reasons for correcting the figures put forward by Madras in Volume III of their Reservoir Project of the estimated river discharges for higher gauges than 7·0′ at Cauvery Dam and for raising the estimate of average annual yield of the catchment at this point from 425,000 mills. c.ft. to 450,000 mills c.ft.

26. Buckley's irrigation pocket-book, page 213, second edition, gives the total average run-off for certain of the Madras rivers including the Cauvery having an aggregate catchment area of 85,000 square miles as 2,000,000,000,000 c.ft. = 23·5 mills. c.ft. per square mile, which, for the 26,172 square miles of the Cauvery catchment above the Cauvery Dam, would give an annual average yield of 595,000 mills. c.ft. or 32 per cent. in excess of the revised figure quoted in paragraph 25.

27. In order to check these totals independently, I have estimated the yield from the catchment in Appendices A.E. VII, VIII and IX of this note. Appendix A.E. VII is a tracing from the latest published (1912) irrigation map of India showing isohyetic lines based on the mean average rainfall of the past thirty years. Appendix A.E. VIII is a diagram showing yields in million cubic feet per square mile for varying mean annual rainfall from 20″ to 120″. In the lower part the curves are based on Strange's diagrams and are continued for rainfalls higher than 50″.

28. In using the diagrams I have not taken full credit for the whole yield as shown thereon but have allowed proportionate reductions for losses *en route*. Even so the computation Appendix A.E. IX works out to a total yield at the Cauvery Dam of 625,000 mills. c.ft., an excess of 39 per cent over the revised figure based on the Cauvery Dam gaugings quoted in paragraph 25.

29. One obvious cause of the increase is that my total area, 29,485 square miles, is in excess of the area recorded by Madras, 26,172 square miles. Similarly, the area at Kannambadi in my computation, 4,639 square miles, is in excess of the area accepted by Madras and Mysore, 4,000 square miles.

30. This is evidently due either to an error in the planimeter with which my areas were computed or to stretching of the map from which they were taken; in either case the error is proportional, and I have therefore applied corrections to all areas in the ratio 262 : 295 in Appendix A.E. IX (*a*).

31 The corrected total yield comes to 563,000, a difference of 5·4 per cent below Buckley's figure and of 23 per cent over the figure based on the Cauvery Dam gaugings.

32. Considering these figures and the very moderate ratios of yield which I have assumed in my computation, I think it probable that the Cauvery river discharges based on the Cauvery Dam gaugings are still too low for the higher floods; but I do not propose to amend these further as it does not appear that the estimated supplies in the years of low supply, which are of course the critical years both for Madras and for Mysore, are likely to be materially affected.

33. Appendix A.E. X shows a rough division of the estimated total yield between the south-west and north-east monsoons. The south-west contribution is admittedly the more important and gives the greater part of the total yield, the rainfall is heaviest in the hilly tracts gradually decreasing towards the plains.

34. A reference to Appendix A.E. X and the map Appendix A.E. VII will show that, for my estimate of the south-west yield, I exclude all areas on which the mean rainfall is less than 34″ per annum and consider an area of 7,747 square miles only as compared to the 16,000 square miles in round figures which is stated to receive this monsoon—*vide* paragraph 4, Vol. I, Madras Cauvery Reservoir Project. It will be seen that the area I consider includes all the hilly tracts which admittedly contribute the greater part of the south-west yield and excludes the plain area from which the contribution is comparatively small.

35. For the north-east monsoon I include all areas excluded from the south-west except in the Kannambadi in which I also include an area of 1,210 square miles already included in the south-west monsoon and on which the average annual

fall is 35". Thus the area considered as contributing to the north-east monsoon is 19,614 square miles as compared with the figure given by Madras of 10,000 square miles.

36. These assumptions are admittedly arbitrary and rough though they agree generally with the evidence as to the incidence of the total annual fall in the two monsoons. They have been made for the purpose of checking any other calculations of the proportionate yield from the Kannambadi catchment which may have to be considered in the course of the Arbitration.

37. The following points brought out by these estimates are noted. The south-west monsoon contributes about 75 per cent of the total annual yield and the north-east about 25 per cent. In paragraph (5), Vol. I, Madras Cauvery Reservoir Project, the proportions are given as 78 per cent and 22 per cent, respectively ; the difference is not great.

The catchment between Metur and Bhavani including the Bhavani itself contributes 76,020 mills. cubic feet or 1/5·4 of the discharge at Metur.

In paragraph 24, Vol. I, Madras Cauvery Reservoir Project, the Bhavani discharge is given as 70,000 or one-fifth of the river discharge at Bhavani—again the difference is not great.

The Kannambadi catchment contributes 48 per cent in the south-west monsoon and 14 per cent in the north-east monsoon of the estimated yield at the Cauvery Dam for these respective seasons.

The question of what further allowances, if any, have to be made for other existing claims for irrigation or for losses in transmission between Kannambadi and the Cauvery Dam has to be considered separately and will be dealt with later.

PART II.

Assessor's Examination of the Evidence on Term of Reference 2 (b).

Limit gauge and supplies necessary for irrigation.

Before examining the evidence in support of the respective claims advanced by either party under this head it is desirable to point out that logically a limit gauge claim for irrigation purposes can only be considered in close reference to the supply or volume of water which it connotes, except in so far as it may also affect what is technically known as "command."

2. The major issue in this case depends wholly on the limit gauge connoted with the supply—it is only in minor issues that the "command" has been referred to by either party—in other words so far as the delta irrigation, which is much the more important interest, is concerned, it is the quantity of water connoted by the limit gauge claim which has to be considered; and command, so far as it has been alluded to by either party, has to be considered only in reference to the channels deriving their supply from the river above the Cauvery Dam, which is of comparatively lesser importance.

3. The necessity of considering the limit gauge claim in conjunction with the supply connoted, will at once be clear when remembering the several alterations which have been made from time to time both in the works themselves and in the rules for regulation.

4. Moreover, it is obvious that a limit gauge claim, irrespective of the supply necessary for irrigation, would connote very different quantities in different years depending not directly and as of design on the irrigation requirements but fortuitously on the number of days the limit gauge might be reached. It would, in fact, connote a larger supply in a year of excessive rainfall when the irrigation demand would be a minimum, than it would in a year of deficient rainfall when the demand would be a maximum.

5. On these general grounds I think there can be no doubt but that so far as the Delta area is concerned the quantity of water necessary for irrigation is the essential matter at issue rather than a limit gauge. The two are, of course, interdependent to some degree but by no means absolutely.

6. Madras have defined their claims as a prescriptive right to a limit flow whenever it is available in the river of 2,944 millions cubic feet = about 33,500 cusecs which, they state, is connected by a 7·0′ gauge on the Cauvery Dam under conditions obtaining at the time the 1896 rules were introduced, and prior to the remodelling of the Upper Anicut in 1899-1902. In support of this claim they rely entirely on the rules and records of regulation. They have made no attempt to show that the quantities of water actually taken into the Cauvery under the working of those rules and limit gauge have been essential to their irrigation in the past, and that they are therefore necessary to its conservance in future.

Vide paras 9, 11, 13 and 15, Ma. 9.

Vide para 18, Ma. 9.

7. Mysore, on the other hand, contend that a maximum limit gauge of 6·0′ connoting a discharge of only 18,850 cusecs is ample and all that Madras are entitled to under the 1882 rules; and that prescriptive right has not matured for anything over and above that which the 1896 rules may have implied. They also claim that the limit gauge of 6·0′ is only required in certain months and that less is necessary at other times. In support of these claims they rely partly on the same rules and records of regulation as do Madras, though they also claim that their proposals in fact will give supplies equal to those actually used by Madras for irrigation in the past and therefore adequate to conserve it in future. They also claim that their proposals receive strong support from the provisions for supply made by the Madras Engineers in the Metur Project.

Vide My. 7, 33-37.

8. A point to note with regard to these limit gauge claims, is that both parties rely on rules anterior to the Upper Anicut remodelling to prove the limit gauges, but when converting the limit gauge claim into quantities refer to the much later Madras curve of 1909 dated seven years after the remodelling.

9. The first authentic calibration of the Cauvery Dam gauge was Mead's curve, dated 1866, which was replaced by Montgomerie's curve in 1881. These are very clearly discussed in Madras Appendix XXIII and there can be no doubt but that Mead's curve based on Bazin's formula gave volumes in excess of actual. Also, that Montgomerie's curve based on Kutter's formula is much more accurate than Mead's, and finally that the Madras curve of 1909 based on actual velocity observations is more accurate still.

10. Up to 1881, however, when Montgomerie's curve was first produced, the Madras Engineers were in all probability relying on Mead's curve, a supposition which is strongly supported by Montgomerie's remark referred to in A-7 (15) to (19).

11. Then, from 1881 up to 1909, the Madras Engineers had apparently nothing but Montgomerie's curve to refer to. It follows that, in any consideration of what their intentions as regards supply were when fixing limit gauges at the Cauvery Dam, we must refer to that curve and not to the 1909 curve. It is, I suggest, unreasonable to suppose that the framers of the 1882 rules should not have referred to that curve so recently recorded as a result of Major Montgomerie's special deputation and moreover they had nothing else to refer to.

12. It is to be noted, however, as recorded in Madras Appendix XXIII, that, for the range of what may be accepted as the critical limit gauges in this Arbitration, the difference between Montgomerie's curve and the Madras curve is fortunately not great, and as a measure of volumes actually passing the Cauvery Dam gauge in recent years, as distinct from the intentions of the framers of the rules, I consider the latter as more reliable than the former, as it appears certain that in recent years at any rate channel changes have not been very great, while there can be no doubt as to observed velocities which are the basis of the 1909 curve, being more reliable than calculated velocities which are the basis of the 1881 curve.

13. With this preamble I now proceed to examine the rules of regulation on which both parties very rightly lay so much stress, and, in order to make my examination perfectly clear to all concerned, I must first refer briefly to the past history of changes in the channel and connected works which have from time to time led to changes in the rules.

14. Commencing with the construction of the Upper Anicut in 1836, we find that work leading to so much scour in the Cauvery that in order to check it it was found necessary in 1845 to build the Cauvery Dam. No rules for regulation at this early period are in evidence but it is clear that such existed, since the 1882 rules referred to in A-7 (25) were clearly "revised" rules, and we may gather from the general description of the works and the relative levels of the Upper Anicut crest, of the Cauvery Dam and of the 150 yards Calingulah, which are in evidence, that the designers of those works aimed at a supply in the Cauvery equivalent to practically 6·0′ on the Cauvery Dam gauge before allowing any water to escape into the Coleroon, and that the crest of the Calingulah 0·5′ relatively below that of the Upper Anicut insured, what was probably considered by them, a sufficient quantity to pass down for the Lower Coleroon irrigation, at all times when there was not enough water in the river to exceed the 6·0′ limit on the Cauvery Dam. There is nothing to show what at that time a gauge of 6·0′ on the Cauvery Dam connoted in volume of water flowing into the Cauvery. But seeing that the Delta irrigation at that period was not nearly developed, what was considered, and what, in point of fact, may have been sufficient for the irrigation then, can certainly not be accepted in any sense as a criterion of the rights of Madras to a limit gauge or irrigation supply which have to be considered now.

Ma. 8, paragraph 16, Ma. 8, paragraph 17. A. 7-80.

15. The regulating gauge referred to in the first rules in evidence, is the Cauvery Dam gauge and, for the purpose of ascertaining the intention of the framers of those rules, we must refer to Montgomerie's curve of 1881 of discharges on that gauge, and accept the fact that the gauge limits fixed by those rules connote quantities (read from Montgomerie's curve) which were then considered sufficient to ensure the necessary irrigation supplies; and it will be convenient to consider those rules in connection with the Cauvery and Vennar regulator rules of 1893 which are also the first in evidence for that work.

16. Now it is in evidence that whatever doubt may attach to the reliability of Montgomerie's curve as a measure of the actual quantities, as distinct from intention, passing the Cauvery Dam, owing to its being based on a theoretical calculation of velocities, instead of on the more reliable method of observed velocities, the same objection does not hold in the case of the Cauvery and Vennar discharge tables, which are known to have been regularly checked and corrected from time to time in accordance with actual observations; and it is satisfactory that examination of those records has established the 1893 diagrams with slight correction as a reliable standard of reference for the purpose of this Arbitration—*vide* A-4 (*b*).

17. Thus it is clear that, whatever misconceptions they may have laboured under as regards the actual supplies passing the Cauvery dam, the framers of the rules, for regulation at the Cauvery and Vennar regulators, were fully aware of the quantities of water they were dealing with, and the gauges required to give those quantities.

18. I now proceed to examine the rules in detail. The first set of rules for the Cauvery and Vennar regulators in evidence is dated 26th September 1892 and was formally approved by the Chief Engineer on 11th January 1893; these have to be considered in connection with the 1882 rules of the Upper Anicut regulator which were at that time in force. They are headed "Rules for the Distribution of Water for Irrigation Cauvery and Vennar regulators." Rule (1) lays down that a full and ample supply to the delta is considered to be passing when there is a discharge of 11,240 cusecs into the Cauvery and of 6,104 cusecs into the Vennar. This total amounts to 17,344 and is equivalent to a gauge of 6·1′ on the Cauvery Dam referred to in Montgomerie's curve which was the only one then in existence.

19. This appears to me to prove beyond doubt that it was never the intention to limit the Cauvery Dam gauge to 6·0′ as has been suggested by Mysore, seeing that the discharge for this gauge read from Montgomerie's curve was only 16,300 cusecs and deducting from this 492 discharge over the Calingulah it would have given only 15,908 cusecs at the Cauvery and Vennar regulators instead of the supply required by rule (1) Cauvery and Vennar, and this too, only on the assumption that there were no other abstractions or losses in transmission.

Mysore seem to me to have entirely overlooked this very important point of intention; though it is true that in converting the 6-0′ gauge into volume they refer to the 1909 curve which they give as 18,850 (my reading from this curve is 18,750 but the difference is very small) and deducting from this the 492 cusecs discharge over the Calingulah, this would have given 18,352 cusecs at the Cauvery and Vennar regulators as against the 17,344 cusecs stated full and ample supply required. But the point I wish to make clear is that the results of the 6·0′ limit would have appeared to the framers of the rule as I have stated them above, and that on the supposition suggested by Mysore the two rules would have been inconsistent at the time they were framed. I now pass on to further trace the intention of the rules as evidenced by their logical effect.

20. Under rule (1) of the 1882 rules of the Upper Anicut except after periods of drought, as soon as the Cauvery Dam gauge reached 6·5′ the under-sluices were to be opened for scouring purposes, and a scour allowed until the Cauvery Dam was reduced to 6·0′; the average supply which the application of this rule connoted in the Cauvery was as follows:—

Gauge 6·5′	22,000	cusecs from Montgomerie's curve.
Deduct discharges over 150 yards Calingulah	1,030	
Supply in Cauvery available for delta irrigation, Cauvery and Vennar	20,970	cusecs.
Gauge 6·0′	16,300	cusecs from Montgomerie's curve.
Deduct dischage over 150 yards Calingulah	492	
Supply in Cauvery available for irrigation in Cauvery and Vennar ...	15,908	cusecs.

The mean of these two totals available at the Cauvery and Vennar regulators is 18,439 cusecs or 1,095 cusecs in excess of the "full and ample" supply specified in rule (1) of the Cauvery and Vennar rules; and it is clear that the two rules are logically connected.

21. Again, when there were no local floods and so long as water did not exceed 7·0′ on the front gauge, rule (2) of the Cauvery and Vennar, rules provided for apportionment of supplies higher than those specified in rule (1) up to the limits of 15,000 cusecs Cauvery and 8,140 cusecs Vennar, totalling 23,140 cusecs.

While rule III of the Upper Anicut, after a defined period of scarcity, provided for scour to commence as soon as the Cauvery Dam gauge reached 7·0′, this would have been expected by the framers to give a supply of 25,916 cusecs as follows:—

Gauge 7·0′	27,500 cusecs from Montgomerie's curve.
Deduct discharge over 150 yards Calingulah	1,584	
Supply available Cauvery and Vennar regulators	25,916, which is 2,776 cusecs in excess of the sum of the supplies required at the Cauvery and Vennar regulators under rule (2), transmission losses, etc., being left out of consideration.	

22. And the average supply expected at the Cauvery and Vennar regulators during the period of scour which under the operation of this rule commenced at 7·0 would have been—

Supply at 7·0′ gauge	25,916	when scour commenced.
Supply at 6·0′ gauge	15,908	when scour ceased.
Total ...	41,824 cusecs.	

Average supply .... 20,912 cusecs during scour, which is just about equal to the supply expected under the 6·5′ gauge—*vide* paragraph 20— and it is clear that there was logical connection between these two rules also.

23. The fact that these supplies were susceptible of full control at the Grand Anicut regulator is established in Ma. 8, paragraphs 20, 22 and 23.

24. It thus appears clear that while the provisions of rule I of the Upper Anicut and rule (1) of the Cauvery and Vennar regulators were sufficient for and of design provided for what were considered to be normal full supplies, provision was also made for special or after drought periods when rule III of the Upper Anicut and rule (2) of the Cauvery and Vennar regulators came into joint operation.

25. The provision of supplies at the Cauvery Dam somewhat in excess of the stated requirements for the Cauvery and Vennar both for normal and for special or after drought supplies is in accord with the usual irrigation practice of allowing a reasonable margin for losses of transmission, etc., and there is nothing inconsistent with this practice in rule (1) of the Cauvery and Vennar rules and the prescribed normal limit gauges of 6·5′ to 6·0′ at the Cauvery Dam and in rule (2) of the Cauvery and Vennar regulators and the prescribed special limit gauges of 7·0′ to 6·0′ on the Cauvery Dam.

26. Moreover, in dealing with a fluctuating supply such as that of the Cauvery, it is also in complete accord with irrigation practice to provide over and above the normal full supply required, for the occasional admission into the irrigation channels of a supply in excess of the normal full supply when it is available—this extra provision is in general practice taken at about 25 per cent of the normal full supply and we see that, in rule (2) Cauvery and Vennar, the provision made is about 33 per cent above that specified in rule (1) or rather more than what is generally allowed. There is of course nothing illogical in this.

27. In fact there was a studied and logical connection between the Upper Anicut rules of 1882 and the Cauvery and Vennar regulator rules of 1893, which is

what one would have expected. The framers obviously knew what supply they wanted and framed their rules to ensure getting it.

28. Above the limits prescribed in rules (1) and (2), Cauvery and Vennar rules, under rule (3) water was to be admitted arbitrarily to the Cauvery up to 7·0′ on the rear gauge and then under rule (4) into the Vennar arbitrarily up to 8·0′, these gauges denoting discharges of—

7·0′ Cauvery	...	..	...	...	29,942
8·0′ Vennar	...	...	...	...	9,625
				Total ...	39,567 cusecs

which is 21,223 in excess of the normal full supply required under rule (1) Cauvery and Vennar.

29. Under rule 5 further rises in the river were to be dealt with by arbitrary admission to the Cauvery up to 7·5′, the combined discharges then being:—

Cauvery 7·5′	...	...	...	...	34,694
Vennar 8·0′	...	...	...	...	9,625
				Total ...	44,319 cusecs

which is 26,975 in excess of the normal full supply.

30. There is a marked difference of opinion between the two parties as to the quantities of water in excess of the limits prescribed in rules (1) and (2) admitted to the Cauvery and Vennar channels under the operation of the rules 3, 4 and 5 Cauvery and Vennar rules of 1893. Mysore claim that these supplies had reference not to irrigation but to flood regulation. Madras claim that flood regulation or admission of water to the channels for other than irrigation purposes only commenced under rule (5) when the difference in front and rear gauges exceeded 4·5 feet; and, in Appendices II and XVIII, they have gone to a considerable labour to demonstrate how very little flood regulation as defined by them has affected the supplies entering those channels.

31. Very valuable light is thrown on this matter by a perusal of Montgomerie's report which is referred to briefly in A-(7), paragraphs (6), (7), (9), (10), (11), (12) and (14), in which he laid very great stress on the importance of flood regulation.

32. The point is moreover particularly emphasised in his letter forwarding the report to the Chief Engineer referred to in A-(7), (4) in which the effect on the irrigation of the flood regulation advocated is also very prominently brought (I might almost say forced) to the notice of the Chief Engineer.

33. The further extracts from his report put in by Madras (Ma. 16) are, I think, intended to emphasise this point, *i.e.*, irrigation supply as being of even more importance than the flood regulation.

34. The argument in this connection is somewhat hard to follow as it is combined with the argument as to the mistake made in the former estimates of quantities of water reaching the Delta which was attributed and was probably almost, if not entirely, due to the error in Mead's curve pointed out by Montgomerie.

35. But, unless the Delta irrigation had thereby been shown to have suffered in the past which was never suggested, the discovery that less water had been actually reaching the Delta than had been thought to be the case would be a perfectly sound reason for thereafter limiting the supplies to what had been actually utilised, but could certainly not be considered a sound reason for increasing the supplies above what had before been reaching it.

36. Montgomerie in his anxiety to get more flood water into the Cauvery and Vennar Delta channels for reasons which he very clearly defined, went so far as to recommend the entire reconstruction of the Grand Anicut, which recommendation however was not adopted.

37. Even admitting that there is room for difference of opinion on this particular point, there is absolutely no doubt but that the matter in its dual aspect was very prominently brought to the notice of the Chief Engineer.

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38. It is to be presumed that it was duly considered and the result is to be traced in the rules for regulation I have already examined: it is only reasonable to suppose that these were framed in full view of all the requirements as stated by Montgomerie and that the 6·5′ limit was considered sufficient for normal and the 7·0′ limit sufficient for special irrigation requirements.

39. The alteration made in 1896 to the Upper Anicut rules of 1882 raising the limit gauges to 7·0 and 8·0 to which I shall presently have to refer at length, is clear proof that it was open to those in authority in 1882 to fix the irrigation limits for the Cauvery Dam at 7·0 or over, if they had then thought it necessary, since there was no change to the Upper Anicut works between 1882 and 1896 and what was possible in 1896 was possible in 1882.

40. Again, while in order to secure a required normal full supply from a source subject to natural fluctuations there is ample precedent in general irrigation practice to provide for such excesses over normal supply, as I have shown were provided for in the 1882 rules and in the Cauvery and Vennar rules (1) and (2), there is no precedent for the provision of such large excesses as those of 21,223 cusecs and 26,975 cusecs over a normal full supply of 17,344 required under rule I as I have shown the working of Cauvery and Vennar rules 3, 4, 5, led to—*vide* paragraphs (28) and (29).

41. On these grounds I consider that the limits of the 1882 rules I and III of the Upper Anicut regulation read with the 1893 rules (1) and (2) of the Cauvery and Vennar must be accepted as the intentional limit of what was considered necessary for irrigation supplies, and that the provisions of rules 3, 4 and 5 of the Cauvery and Vennar rules must be accepted as for flood distribution between the two rivers. The whole tenor of the further rules for regulation at the Cauvery and Vennar regulators, Madras Appendix I, X, XI, XII and XIII, confirms this view: and it is also very strongly supported by the extract from Chief Engineer's note on the subject extracted in A-7 (78) 41 (*a*). While I have arrived at this conclusion independently from my examination of the recorded evidence, it will be seen to receive the very strongest support from the following extract from the Metur Project, Volume III, page 28, paragraph 34:—

"The maximum steady duty contemplated for the transplantation season has been 44 acres per cusec for Cauvery (3 cubic yards per acre per hour) and 66 acres per cusec for Vennar (2 cubic yards per acre per hour).

"The river flow being very fluctuating, the rules provide for carrying water in excess of these duties in both rivers when available up to a fixed level in each river. Over and above this level water is not carried unless specially asked for or required for purpose of surplusing off the superabundant flood waters of the main river —*vide* 'rules for regulation of water at the Grand Anicut,' page 35.

"The depths of flow fixed by these rules are:—

—		Gauge reading in rear head regulator	Corresponding flow cusecs	Duty acre per cusec
	ACS.			
Cauvery	486,000	4·5	13,000	37 ,,
Vennar	406,000	7·0	7,850	52

The many references in the Cauvery-Vennar Regulator rules to 4·5′ and 7·0′ on the rear gauge of the Cauvery and Vennar, read in connection with the above definite statement, appears to me to satisfactorily establish that these gauges have for very many years past been regarded as the limit gauges necessary to give required irrigation supplies to the Delta. Referred to the standard these gauges would mean—

Cauvery ...	14,000
and Vennar ...	7,600
Total	21,600

cusecs as compared with the total 20,850 given in the extract above, and with the 23,140 given in rule 2 of the Cauvery and Vennar rules of 1892.

The differences in the supplies connoted are in all probability due to the different discharge curves or tables which are known to have been checked by observation and corrected from time to time.

Hence, so far as intention goes, as evidenced by the rules, I think we must accept the fact that limit gauges required to give the irrigation supply considered necessary for the Cauvery and Vennar, and to attain which the rules were framed, are as stated: and that regulation for irrigation has for many years past been subject to these limits except perhaps for alternate running when full supply was not available—*vide* last rule of Cauvery and Vennar rules of 1902, Madras Appendix I (xi).

For the Cauvery Dam the limit gauge fixed in order to give those necessary irrigation supplies must be held to lie somewhere between 6·0′ and 7·0′ on the Cauvery Dam gauge and the supply connoted so far as intention goes must be read from Montgomerie's curve.

In both cases of course the framers of the rules were fully aware of the fact that, during floods, gauges higher than the limits fixed by them for irrigation regulation purposes were bound to be attained from natural causes beyond their control; but regulation, as evidenced in the rules, above the gauges I have specified, was undoubtedly for flood distribution as distinct from irrigation distribution.

42. No further changes to works at the Upper Anicut and Cauvery Dam are recorded up to 1896; yet, in that year, we find a new set of rules raising the limit gauges for the Cauvery Dam and then followed the remodelling of the Upper Anicut, 1899—1902, the first avowed object of which was "to reduce the amount of sand being forced down the Cauvery branch and to make the two rivers take a fairly equal share of the sand burden". This report is dated March 1897, within a year of the change of rules dated May 1896, and was submitted by Colonel Smart who also framed those rules, he being at the time on special deputation for investigating the matter of supply.

Paragraph 1 of Report on the Upper Anicut Remodelling.

43. It appears to me that neither party have realised the full significance of this change. Madras refers to it but briefly (paragraph 32, Ma. 8); Mysore suggest reasons for the change (paragraph 42, Part II, My. 7,) which Madras contest, but the full significance of the change appears to be as follows:—

It is clear that the 1882 rules sufficed to give not only what were considered adequate supplies but also to give supplies which were in point of fact sufficient for the Cauvery Delta irrigation for many years. The diagram of irrigation effected in the delta given in Ma. 9 shows that there was general slight improvement in areas under the operation of the 1882 rules up to 1892, and that in this period the general average was higher than it has ever been for any other equal period in the history of the Delta irrigation: moreover it contains the record areas of 1890, 1892.

43.-A. There was a drop in area in 1893 which continued to 1896. There is nothing in the evidence to indicate to what this was due. It may have been due to causes connected with the changes just then being completed at the Cauvery-Vennar head, the old Vennar head was closed only in 1894 (Ma. 8, 22) or it may have been due to silting at the Cauvery Dam, or to other outside causes quite independent of the works and regulations.

44. Whether it was in consequence of this drop in irrigation areas or not, it is significant that in 1895 Colonel Smart was specially deputed to examine the conditions of supply, and it was at his suggestion that the normal limit gauge 6·5′ of the 1882 rules was raised to 7·0′ and provision made for maintaining even a higher limit of 8·0′ on a falling flood, and it is in evidence that before the remodelling of the Upper Anicut silting troubles were recognised which culminated in the sanction of that work, one of the objects of which was to remedy them.

Paragraph 31, Ma. 8.
Paragraph 33, Ma. 8.

45. Why then were the rules of 1896, which would obviously intensify a recognised evil, introduced before the evil itself was remedied? Surely, because, it was considered that the lower limit of the 1882 rules was no longer giving the necessary irrigation supplies in the Cauvery—in other words, that the discharge capacity of the channel* had gradually

* The Cauvery head.

deteriorated owing to the recognised silt trouble, and that it was no longer discharging up to the limit gauge the quantities it had been discharging in 1882 when the former limit was fixed.

46. It must, I consider, be accepted that both sets of rules aimed at and were based on a certain necessary supply, and not at a gauge irrespective of supply.

47. It is most unfortunate that Colonel Smart's original report referred to in A-7 (24) recommending the changes in the limit gauge embodied in the 1896 rules is not forthcoming, as it would almost certainly have put this matter beyond all doubt—but his marginal remark referred to in A-7 (25) is inexplicable on any other theory but that he considered the Cauvery was no longer giving the supply gauge for gauge it had given formerly.

48. Had he considered that there had been no deterioration of the Cauvery channel, and that more water was required than had previously been necessary, it is only reasonable to suppose that he would also have raised the limits of the Cauvery and Vennar rules (1) and (2), which, however, he left untouched, though there is ample evidence that he had them under close consideration, and that his missing report dealt with the whole subject of supply comprehensively, as is clearly proved by a perusal of the numerous enclosures to the report which are still available in original—*vide* A-7, (25) to (32).

49. It appears therefore certain that the raising of the limit gauge incorporated in the 1896 rules was recommended by Col. Smart in the belief that there had been deterioration of the Cauvery channel due to silt and with a view to rectifying the resulting reduced supply as a temporary measure immediately necessary and that, with a view to a permanent remedy, he framed the estimate for the Upper Anicut remodelling as is proved by his report giving this as the first object of the expenditure—*vide* A-7, 74 (*a*).

50. The remodelling of the Upper Anicut was no doubt expected to lead to rectification of the silt trouble it was designed to cure; but its effect may not have been expected to be immediate, it may have been supposed that it would require sometime to remove the silt deposits supposed to be due to the former unsatisfactory conditions; thus we find the 7·0′ limit adhered to in the rules of 1899 when the remodelling was commenced and in those of 1902 when it was completed, though it is clear that both these sets of rules were only applicable to the Upper Anicut before remodelling. The rules of 1905 introduced after two flood seasons had been experienced after completion of the remodelling while retaining the 7·0′ limit for a rising flood already indicate some real or supposed improvement since the 8·0′ limit of the 1896 rules for a falling flood was dispensed with. These are the rules still in force.

51. If this reasoning on the evidence be logical, it must be accepted that the raising of the limit gauge in the Cauvery Dam rules of 1896 was introduced to temporarily meet the unsatisfactory conditions recognised as then obtaining and that it is no longer necessary if those conditions have been corrected as was expected by the remodelling of the Upper Anicut and if the irrigation supplies connoted by the higher gauge when it was raised in 1896 are now obtainable with the lower gauge in the more efficient channel.

52. In the foregoing examination of the evidence as to the 1896 change, I have so far purposely refrained from any notice of the evidence put in by Madras on the specific question of the silting of the Cauvery, and this has now to be examined in this connection.

53. I refer first to Exhibit Ma. 17, in which the suggestion is made that no very great changes had taken place at any rate for several years before 1898 which would of course cover the period in question.

Again, in Ma. 17 (*a*) comparison is given showing an increase of silt averaging 0·68 in the mean bed of the channel at the Cauvery Dam as between 1867 and 1909 and the suggestion is made as regards the Aganda Cauvery, *i.e.*, above the Dam, that, while there had been considerable change in the left half of the section, there had been but little change in the right half of the section.

And, finally in Ma. 17 (*b*), the suggestion is made that the records of annual River Surveys which had been traced after Ma. 17 and 17 (*a*) were written, shew

no indication of any marked change in the condition of the bed between 1885 and 1910 and that the 1867 section points to materially similar conditions prevailing even then.

54. I may say at once that these general conclusions are perfectly logical and are fully supported by the records which were produced for examination by Madras and examined by myself and by the Mysore representative.

55. But then the question arises, how does this evidence affect the change in the 1896 rules? Why were these records which are now shewn to have been available year by year ignored by Colonel Smart and by the Chief Engineer who respectively recommended and approved the raising of the limit gauge in the 1896 rules and the remodelling of the Upper Anicut? Was the existence of those records unknown to those officers or were they purposely set on one side as unreliable in the light of the drop in areas from 1893-1895 and of Colonel Smart's special investigation?

55-A. The supposition that there was real silt trouble at the Cauvery Dam which would account for the action taken to remedy it, receives some independent support from a report by Mr. Griffith on the Cauvery-Vennar discharges in which he compares mean bed levels in the Cauvery 400 d.s. of the regulator for 1900, *i.e.*, before the Upper Anicut remodelling and for 1904, *i.e.*, after the remodelling—*vide* A-4 (*a*) end paragraph.

56. However this may be, there can be no possible doubt but that the raising of the limit gauge in 1896 was proposed and approved by responsible officers of the Madras Government because they believed that there had been deterioration of the Cauvery due to silt and because they considered it was necessary to ensure their getting the same quantity of water they had been getting under the old rules previous to the deterioration even at the risk of temporarily enhancing the silt trouble; and in the same belief the Upper Anicut was remodelled to permanently rectify the supposed deterioration.

57. To assume that the channel had deteriorated previous to 1896 and has improved since the 1899-1902 remodelling of the Upper Anicut is only to assume that the change in the 1896 rules was necessary, that the expenditure incurred in the remodelling was justified and that the Madras Engineers were successful in the measures taken by them for the avowed purpose of correcting a recognized evil.

To assume that the channel had not deteriorated previous to 1896 and has not improved since, is to assume that the change in the 1896 rules and the remodelling of the Upper Anicut, at any rate as regards its first avowed object, were both unnecessary.

58. In either case, it is clear that, in order to ascertain the limit gauge to which Madras are entitled, connoted with the supply necessary for irrigation, we must go back to the rules obtaining from 1882 to 1892, a period which I repeat ranged higher in point of areas irrigated than any other in the history of the Delta irrigation.

59. This clears the case of any objection to the 1896 rules considered as a proof of rights acquired by Madras which might be taken to them under the prescription clause of the 1892 Agreement; and it renders unnecessary any consideration of the arguments on this point advanced by either party.

60. I now proceed to examine the claim put forward by Madras for a specific supply to the Lower Coleroon irrigation as distinct from the Cauvery Delta proper; and, as this supply in the past has been and in the future must continue to be intimately connected with water used for scour, since any water so used was and still must be passed on to the Coleroon, it will be convenient to consider the two together.

61. Madras claim in Part III, Ma. 9, paragraphs (9) and (11), the limit flow of 7·0′ on the Cauvery Dam with undersluices closed as follows:—

	MILLS. C. FT.
Over Cauvery Dam	2,300
Over Upper Anicut	644
	2,944 m. c. ft., or,

approximately 33,856 cusecs which includes water for scour.

It is in evidence that the 644 m.c.ft., claim over the Upper Anicut equal roughly to 7,400 cusecs, is considerably in excess of what is estimated as required in Ma. 8, paragraph 37, for the Coleroon irrigation, *viz.*, 2,240 cusecs only; but Madras plead that the conditions of the supply levels at the Lower Anicut and in the Vadavar necessitate very large unavoidable surpluses to the sea over the Lower Anicut (*vide* Ma. 8, paragraph 38 and Ma. 9, paragraph 10).

62. They, however, recognise that to claim all floods up to the limit required to give them their full supply in the Vadavar including the unavoidable waste to the sea would be too onerous a burden to put on Mysore, and they therefore forego this claim in consideration of the specific supply claimed in lieu thereof at the Upper Anicut.

63. They make no attempt to shew that the quantity claimed has been necessary to the maintenance of their Coleroon irrigation in the past, and that it is therefore necessary to conserve it in future. They rely solely on the rules and regulations of the past to shew that they have used the quantities which they claim and that they are therefore entitled to them in future.

64. Mysore, on the other hand, claim that the discharge of 644 mills. c. ft. for the Coleroon irrigation is based on what was under the rules of 1882 in the nature of wasteful use entailed by artificial conditions inherent in the Madras works (My. 7, paragraph 66), and not on supply necessary for irrigation and passed down specifically for that purpose, and they support this by the argument that the stopping of the scour flow to the Coleroon by the change in the rules after the 1902 remodelling, is in itself proof that it is not required for irrigation or for scour under conditions now obtaining (My. 7, paragraph 67). They point out the disproportion of this demand considered as an irrigation demand and as compared with that of the Cauvery Delta proper, and they support this view by a reference to the Metur Project framed by Madras (My. 1 (11)) in which no such separate allowance for the Coleroon irrigation was made.

65. I do not think, I need follow in this connection the further arguments of either side through their rejoinders: they adhere throughout to the claims as I have briefly stated them here, and these are the main points to be considered and examined in light of the evidence.

66. I now proceed to examine in detail what was the actual effect on the scour and Coleroon supply of the change in rules of 1905, using, for the purpose, supplies taken from the 1909 curve as being probably more nearly actuals than Montgomerie's, and accepting the discharges given in Ma. 8, paragraph 37, for the Upper Anicut undersluices and Calingulah.

67. From these data under conditions before remodelling the Upper Anicut, and with a gauge of 6·0 on the Cauvery Dam, there would have been going to the Cauvery, 6·0′, 18,750—492=18,258 and to the Coleroon,

Over Upper Anicut	828	
Over Calingulah	492	
	1,320	cusecs,

the total supply of the river then being 18,750+828=19,578 cusecs.

68. Under rule I of 1882 for a normal supply with gauge 6·5′ Cauvery Dam the following conditions obtained:—

Cauvery Dam 6·5	22,750	
Over Upper Anicut	3,884	
Total ...	26,634	cusecs,

of which the following quantities were automatically passing down to the Coleroon:—

Over Upper Anicut	3,884	
Over 150 yards Calingulah	1,030	
Total ...	5,914	cusecs,

leaving 20,720 for the Cauvery.

69. Scouring then commenced which was continued until the Cauvery Dam gauge fell to 6·2′, when, assuming the total river supply to have remained steady, the conditions would have been—

Cauvery Dam 6·0′	18,750	
Over Upper Anicut	828	
	19,578	cusecs
Under sluices	7,056	„
Total river supply ...	26,634	cusecs.

Of this total quantity 8,576 cusecs would have been going to the Coleroon, and the balance 18,258 cusecs to the Cauvery.

70. Similarly, for a gauge of 7·0′ on the Cauvery Dam, before remodelling, the following conditions obtained without scour:—

At Cauvery Dam	26,500	cusecs
Over Upper Anicut	7,456	„
Total river supply ...	33,956	cusecs.

Of this total quantity 7,457 over Upper Anicut, and 1,584 Calingulah, total 9,040, was going to the Coleroon and the balance 24,916 to the Cauvery.

71. With scour, assuming the river supply to have remained steady, the conditions would have been—

Cauvery Dam 6·5′	22,750	
Upper Anicut	3,884	
	26,634	
Under sluices or Upper Anicut ...	7,322	
Total river supply ...	33,956	cusecs,

of which 21,720 was going to the Cauvery and the balance 12,176 to the Coleroon.

72. Now the 1902 and 1905 rules did away with a great deal of this passing of water for scour, and consequent supply to the Coleroon, and for all gauges less than 7·0′ the Coleroon got supplies only over the Calingulah as follows:—

Cauvery Dam 6·0′	492	
6·5′	1,030	
7·0′	1,584	

and for gauges above 7·0′ the rules provided not for specific scour down to a 6·0′ limit on Cauvery Dam as in the 1882 rules, but for scour only as the river rose above 7·0′, when the difference between the total and the 7·0′ on Cauvery Dam was to be used for scour: in other words, the 7·0′ gauge on Cauvery Dam was to be maintained, and only excess over this passed through the Upper Anicut for scour and of course into the Coleroon.

73. The effect of the change of rules in 1902 and 1905, on the distribution as between the Cauvery and Coleroon of river supplies connoted by gauges 6·0, 6·5 and 7·0 feet on the Cauvery Dam, under the conditions obtaining before remodelling of the Upper Anicut, is illustrated in the following statement:—

Statement comparing distribution as between Cauvery Delta and the Coleroon including scour under the Upper Anicut rules of 1882 and 1905.

Gauge	Total supply in river under 1882 conditions	Distribution of the river supplies given in column 2			
		Under Upper Anicut rules of 1882		Under Upper Anicut rules of 1905	
		To Cauvery	To Coleroon	To Cauvery	To Coleroon
1	2	3	4	5	6
	Cubic feet per second				
6·0	19,578	(*a*) 18,258	1,320	(*a*) 19,000	578
6·5	26,634	(*a*) 20,720 (*b*) 18,258	5,914 8,376	(*a*) 25,000	1,634
7·0	33,956	(*a*) 24,916 (*b*) 21,780	9,040 12,236	(*b*) 25,000	8,956

(*a*)—Without scour. (*b*)—With scour

74. Inspection of these figures is enough to show conclusively that the change in rules of 1902 and 1905 connoted very largely reduced supplies to the Coleroon, and very largely increased supplies to the Cauvery than had obtained previously: similarly, it connoted very large reduction in the water previously used for scour.

75. A reference to the diagram appended to Ma. 9 will show that the Coleroon irrigation has been even steadier in point of area in the past than has that of the Cauvery Delta, and that the period since the remodelling of the Upper Anicut in 1902 has been on the whole slightly higher than it was in the years 1882—1892, which was the best period for the Cauvery Delta proper.

And this brings us face to face with the question as to whether the claim of Madras to the 644 millions cubic feet for scour and for the Coleroon irrigation can be held to be due to them as of necessity and under terms of the 1892 Agreement.

76. While the decision on this point must ultimately depend on the view the Arbitrator takes of the interpretation of that Agreement, as Assessor I must record the following categorical questions and answers based on the evidence which appear to me to be very relevant to the decision so far as it may turn on the facts as to necessary use in the past and the conservance of existing right in the future.

77. *Question* (1).—Does examination of the evidence show that the decrease of quantities of water to the Coleroon consequent on the change of the rules for Upper Anicut in 1905 has in any way been prejudicial to the Coleroon irrigation ?

Answer.—No. On the contrary it is shown by the diagram Ma. 9 to have slightly increased.

Question (2).—Does the evidence show that the Cauvery irrigation has benefited in any way by the change in those rules ?

Answer.—No. On the contrary the same diagram shows there has been slight decrease as compared with the period up to 1892 when the old rules were in force.

Question (3).—Does the evidence show that the water formerly used for scour under the 1882 rules is now necessary for the purpose of maintaining the channels in an efficient condition ?

Answer.—No : though there is strong presumptive evidence that about 1893 there was some deterioration in the Cauvery channel and consequent reduction in its supply for a given gauge due to the conditions and rules obtaining before that date—it is clear that since the 1902 remodelling any such defects as may have existed have been remedied and that the channel now is as efficient as ever it was since 1881.

78. Hence so far as the necessity for the extra supplies passed into the Coleroon under the 1882 rules whether for the Coleroon irrigation or for scour is concerned, I consider that Madras cannot be held to have proved their claim to this specific supply, and I consider that any fair and reasonable treatment of this point in terms of the 1892 Agreement demands its exclusion from the estimate of quantities due to Madras for the purpose of the award in this Arbitration.

That the Madras Engineers who framed the latest rules of 1905 for the Upper Anicut, Madras Appendix 1 (V), which are those still in force, were of opinion that there was no necessity for special supplies to the Coleroon except those over the Calingulah until the Cauvery Dam gauge reached 7·0′, is evidenced in rule No. 4 in which for a gauge of less than 7′0′ stoppage even of leakage at the Upper Anicut gates is enjoined ; and this same opinion that no special supply beyond that from the Calingulah was necessary for this irrigation is also very definitely stated in the Metur Project report. Had my examination of the effect on the irrigation of the stoppage by the rules of 1902—1905 of supplies formerly due to the discharge over the Upper Anicut and to those under the operation of the 1892 rules for scour, resulted in showing that the irrigation had in any way suffered, I should have had no hesitation in setting aside those opinions as erroneous ; but, as it is, they cannot be ignored and can only be considered as giving the strongest possible support to my deductions from the other evidence.

79. Before leaving this subject I may also record that, as has been admitted by Madras, the present arrangements for control of supplies at the Lower Anicut

entail much unnecessary waste, and if these defects were remedied there can be no doubt but that the Coleroon irrigation would be much more secure than it has been with much smaller supplies than it has received in the past.

80. Eliminating the specific claim of 644 mills. cubic feet which as stated in paragraph (78) I find not to be supported by the evidence, the Madras claim is reduced to 2,300 millions cubic feet = 27.250 cusecs (which is equivalent to about 7·1′ on the Madras curve of 1909) and they claim this supply whenever it is available in the river; it is for consideration whether this claim can be shown to be due to them by prescriptive right as having been utilised by them for irrigation purposes in the past, and as necessary for its conservance unimpaired in the future.

81. Now, the 1882 rules show that under normal conditions, *i. e.*, except after defined periods of drought as soon as the Cauvery Dam reached 6·5′ scour commenced and was continued till it fell to 6·0′ ; while, after specially defined periods of drought, the Cauvery Dam gauge was maintained till 7·0′ was reached when scour was at once commenced : this, I have shown in paragraph 71, would, on the assumption that the river supply remained steady, have reduced the gauge to 6·5 or perhaps a little less.

82. There is nothing in the evidence to show how long it took to fully open the scouring sluices, probably 6 to 8 hours would suffice for this operation; but it is not very material to the point under consideration, which is whether the rules as they stand do or do not support the Madras claim for the 7·0′ limit gauge whenever it is available in the river.

83. It is clear that under the operation of these rules the irrigation supply apart from scour used by Madras for the Cauvery Dam was the mean between a 6·5′ and a 6·0′ gauge for periods of normal demand and the mean between a 7·0′ gauge and a 6·5′ gauge for special periods following drought, and it is clear that the rules do not in themselves support a claim to the 7·0′ limit whenever it is available in the river.

84. Again, in Ma. 9 (8) it is stated that, under the operation of the rules during ten years of the period 1882—1895 for which records are available, scouring took place under the 6·5′ limit on 26 occasions as against 33 occasions under the 7·0′ limit, which is clear proof quite apart from the rules themselves that Madras in the past did not avail itself of the 7·0′ limit whenever it was available in the river but only at certain times after clearly defined and specified drought conditions.

85. Unless, therefore, the 7·0′ limit can be shown to be necessary for the conservance of the irrigation which I shall examine later, it cannot be held that the rules themselves or the records of their operation support this claim.

86. I now have to examine the evidence as to " Command", that is to say, levels or limit gauges in their reference to this particular requirement which is almost entirely a matter of user.

87. On the main case, that is, as regards the Cauvery Delta irrigation " Command" has not been referred to specifically or directly by either party and I need only notice it briefly:—there is, of course, strong presumptive evidence that the limit gauges fixed under the 1882 Upper Anicut rules and the 1893 Cauvery and Vennar rules were such as would give the requisite water levels at the various distributing points on the system and, in absence of any evidence to the contrary, we may safely accept that, provided the limit gauges on the Cauvery Dam are secured in future to the same extent as they have formerly been enjoyed and utilised in the past, there will be no prejudice to any irrigational interest or established right of user in this matter of command. This view, moreover, is very strongly supported by the enclosures to Colonel Smart's missing report referred to in A-7 (31) and (32) which show that he had this matter under his special consideration.

88. As it affects the Coleroon, *i. e.*, Vadavar supplies and the conditions of regulation at the Lower Anicut, the matter has been referred to at some length by both parties. As to this all I need say is that the evidence shows that, in spite of very obvious defects in the control afforded by the Lower Anicut which is admitted by Madras, they have been able in the past to maintain necessary supplies with the quantities passed down under the Upper Anicut rules of 1882 and 1905, although the latter very seriously curtailed supplies formerly sent down under the operation

of the former ; and that there is nothing in the evidence to show that the irrigation will suffer in any way if the supplies to the Coleroon available in the past under the operation of the 1905 rules are secured in future.

89. I would, however, repeat that there is obviously room for very considerable improvement in the control afforded by the Lower Anicut, which if carried out would certainly make necessary supplies much more secure in the future than they ever have been in the past should it ever appear desirable to do so.

90. It is in reference to the supplies of minor canals taking out from the river above the Upper Anicut that the question of command has assumed the importance given to it in the evidence. Madras at first, and under a misconception, claimed a Cauvery Dam gauge of from 7′ to 7·5′ as essential to fully securing necessary supply to these canals (Ma. 14, paragraph 104).

91. Mysore in their reply, My. 12, paragraphs 76-81, urged that this limit could not be necessary as the Metur and other projects had contemplated reducing the Cauvery Dam gauge much below those limits. Madras in reply put in diagrams Ma. 18 (*a*), (*b*), (*c*) and connected records, and in paragraph 52 admitted that 6·5′ on Cauvery Dam would conserve their interests in this respect, which gauge is of course covered by their main claim to a 7·0 gauge, and stated that in the Metur Project the requirements of the channels in the reach above the Cauvery Dam had admittedly not been considered, and that there was no evidence to show that the officers preparing the other projects alluded to by Mysore had considered them either.

92. A further note on this point put in by Mysore (My. 15) pointed out that full supplies in the various channels had been actually obtained with gauges at the Cauvery Dam varying from 5·5′ to 5·9′ and that therefore a limit of 6·0′ on the Cauvery Dam should in any case suffice to ensure them in future. Also, that much lower stages of the river than 6·0′ on the Cauvery Dam were the rule rather than the exception, and that the head sluices of channels dependent for their supply on the main river levels would presumably have been fixed in reference to ordinary rather than flood stages of the main river.

93. This reasoning is quite logical and has not been met in the Madras reply Ma. 21, wherein they argue that the isolated readings on the diagram from which Mysore deduced the 5·5′ to 5·9′ on Cauvery Dam as sufficient to give full supplies may have been due to local drainage. This is quite a sound argument and may be a true one, though, in absence of any specific explanation, it does not account for the other extreme supposition of the highest range of Cauvery gauges shown on the diagram being necessary for full supplies in the channels, nor does it traverse or meet the other Mysore contention which appears to me much the more important.

94. In the absence of any direct evidence to the contrary, we must assume that the designers of these channels designed them with a full knowledge of the conditions they had to meet and in accordance with usual practice ; and it is not reasonable to suppose that they should have fixed the levels for the head sluices so high that normal full supply could only be got in during floods in the Cauvery. The levels for normal supply in the channels would doubtless have been fixed within the range of normal conditions in the Cauvery, which, as pointed out by Mysore, does not reach the limits suggested as necessary by Madras ; while doubtless in accordance with usual practice they would also have provided for extra supplies over and above the normal being taken into the channels during floods.

95. Finally, I may remark that there is nothing in the evidence to warrant the fear that any limit gauge likely to be found due to Madras as the result of this Arbitration would deprive these channels of the necessary supplies they have enjoyed in the past.

Effect of occasional floods.

96. A good deal of stress has been laid by Madras, and rightly, on the beneficial effect of occasional floods on the Delta irrigation. It is clear from the evidence that this has always been recognized by the Madras Engineers who were responsible for framing the rules for regulation, though it is also clear that opinions of certain officers have differed from time to time with regard to the disposal of floods.

97. What I have already written on this subject, paragraph 30 *et seq.*, shows however very clearly the practical effect the officially accepted and effective opinion

has had on the rules and regulation in the past and it is on these that Madras bases its claim.

98. It is nevertheless desirable to show that, even if the officially accepted and effective opinion as to flood regulation on which the rules were based was incorrect, there is no reason to fear that the Delta irrigation will in any way suffer by the mistake, provided that the irrigation supplies passed under the rules and regulation and shown to be necessary for their irrigation in the past, are taken as the basis for the award which must ensure their conservance in future.

99. In order to clearly illustrate this in a practical manner it is necessary to make certain assumptions, as to what the prescriptive necessary supply at the Cauvery Dam is ; and the proportion of it which has been and will have to be contributed from the Kannambadi catchment. But I wish at this stage to guard against either of the assumptions I make for the purpose of illustrating this point, being taken as any indication of the final computations which I shall have to make when my examination of the evidence is complete for the purpose of advising the Arbitrator as to the award.

100. Suppose, for example, that a limit supply of 30,000 cusecs at the Cauvery Dam is found by the Arbitrator to be necessary to fully conserve the Madras rights under the terms of the 1892 Agreement and assume for example that the proportions of this supply due to the catchment above Kannambadi is found to be 50 per cent with 20 per cent added to this for losses amounting to a total to be passed on from Kannambadi of 60 per cent of the Cauvery Dam limit whenever it is available in the river.

101. Now, on those assumptions, provided that the rules to be fixed for the Kannambadi impounding, if the Reservoir is constructed, ensure the passing on from Kannambadi of all actual supplies in the river up to the limit of 18,000 cusecs of which 15,000 cusecs would reach the Cauvery Dam, Madras irrigation supplies could not possibly suffer ; Madras would always get them whenever they were available in the river just as she has had them in the past.

102. Further, it is clear that any increase in the river supply over and above the 30,000 limit at Cauvery Dam can come only partly from the Kannambadi catchment and partly from the remainder of the Cauvery catchment and assuming the same proportions to hold good, the following table indicates the effect which impounding at Kannambadi would have on supplies reaching Cauvery Dam for various stages of river flow and compares them with the supplies which would have reached the Cauvery Dam without impounding :—

Total flow in river now reaching Cauvery Dam.	Source of supply.		Distribution of supply at Kannambadi.			Supplies reaching Cauvery Dam after impounding at Kannambadi.			Increase at Cauvery Dam over limit gauge supply.	
	From Kannambadi 30 per cent.	From other catchments 50 per cent.	Supply at Kannambadi 60 per cent of column 1	Passed on.	Impounded.	From Kannambadi.	From other sources.	Total.	Without impounding at Kannambadi.	With impounding at Kannambadi.
1	2	3	4	5	6	7	8	9	10	11
30,000	15,000	15,000	18.000	18.000	...	15,000	15,000	30.000	...	...
40,000	20,000	20,000	24,000	18,000	6.000	15.000	20,000	35,000	10,000	5,000
50.000	25,000	25,000	30.000	18.000	12,000	15,000	25.000	40.000	20,000	10,000
60.000	30.000	30,000	36,000	18.000	18.000	15,000	30,000	45,000	30,000	15,000
70,000	35,000	35,000	42,000	18,000	24.000	15,000	35,000	50,000	40.000	20.000

A little consideration of these figures will show that, whatever variation of the tentative assumptions from which they are deduced may be found to be necessary as a result of this Arbitration, such variation can only alter them in degree ; that is to say, Madras must continue to get a share of all floods above the limit supplies, though the amount of this share will vary with any variations of the

proportions which may ultimately be determined not on assumptions but on ascertained facts.

103. Thus we see that, while the irrigation supplies due to Madras under the 1892 Agreement would be absolutely secured, she would still enjoy in addition increments over and above those necessary supplies on every day in the year in which she would have enjoyed them under the old conditions, *i.e.*, without the Kannambadi Reservoir, though in diminished quantities. In other words. the surpluses in the river over and above the supplies necessary for the full conservance of Madras rights, would in future be shared by Mysore and Madras; and there is nothing whatever in the evidence to show that, provided the essential principles underlying this examination of the case are observed, there will be any risk whatever to the vested rights of Madras.

104. On the other hand, it is in evidence that, in the past, there has been occasional serious damage from floods in the Delta, and it is only reasonable to suppose that a reservoir at Kannambadi which must act to some extent as a moderator of floods will at certain times tend to mitigate such damage and therefore be beneficial to the Delta.

Hot weather supply.

105. This question is one which, so long as the Cauvery Power Works as at present projected continue in operation—*i.e.*, with the additional power supply to effect which is the primary object of the Kannambadi Reservoir—is already determined by mutual agreement of the two parties. The Mysore project provides for a continuous supply to the Power Works of 1,000 cusecs, and Madras agreed to waive all claims to the hot weather flow, *i.e.*, for the months of March, April and May, in consideration of Mysore passing on from Sivasamudram a continuous supply of 900 cusecs, which is 100 cusecs less than the Reservoir project, together with the Kabbini supplies, is designed to yield for power purposes.

106. It was admitted in My. 7, paragraph 78, that, if the waiver of Madras in consideration of this 900 cusecs continuous supply were withdrawn, it would give Madras only the right to the natural flow of the river after the customary Mysore requirements are satisfied.

The prescriptive right to which they considered themselves entitled and which they agreed to waive in consideration was defined by Madras in Ma. 9, paragraph 21, as the whole natural flow of the Cauvery less what is drawn off for the supply of the directly supplied channels in the Mysore territory.

107. Thus, up to this point there was no disagreement in the matter of hot weather supply except as to the period, to which I shall have to refer later and it was only on reconsideration and in view of possible re-adjustment or discontinuance of the power supply at some future date that the Mysore Government, at a later stage of the enquiry, sought to relieve themselves of the burden of passing on so large a continuous supply as 900 cusecs at all times, irrespective of the actual river supply, since they considered that it would give a larger hot weather supply to Madras than that to which they are by prescriptive right entitled.

108. Any re-adjustment or discontinuance of the supply of 1,000 cusecs provided for in the Kannambadi Reservoir project must depend—(1) on possible re-adjustment of the power works to fit a higher head and therefore requiring a diminished supply or (2) on the exhaustion of the Kolar Gold Reefs which would mean a complete discontinuance of the Cauvery power supply for that purpose. Re-adjustment under (1), so long as the Kolar Gold Field contract for power continues, could only be effected by a completely new equipment, and the scrapping of the greater part, if not all, of the existing headworks, supply channels, power house and machinery.

109. Either of these contingencies I consider very remote, and both parties appear to have overlooked or ignored the great probability, amounting in my opinion to certainty, that by the time either of these contingencies could arise, the prescriptive right of Madras to the 900 cusecs continuous supply must be held to have matured under any fair and reasonable application of the terms of the 1892 Agreement.

110. Further discussion of this matter arose from the qualification of the former admission which was made in My. 9, paragraph 88, where they stated that the Madras claim was understood to be limited to the average estimated flow of the river in the months of February to May, subject to the customary irrigation rights of Mysore. Madras contested this in Ma. 14, paragraph 99, and claimed to hold Mysore to their former admission : they doubtless referred to the special significance given to this word " admission" by, both parties in this Arbitration—*vide* Arbitration proceedings of 21st July 1913.

111. Mysore in their further reply My. 12, paragraphs 72 to 74, explained their reasons for modifying their former admission; and in paragraph 75 definitely raised the issue as to the inclusion of February in the hot weather period, and Madras in their final rejoinder, Ma. 22, part XII, pointed out that some of the data on which Mysore relied were incorrect and due to misapprehension. They also submitted Appendix XXVII, showing discharges in excess of the 1,000 cusecs at Bhavani bridge, and comparing Sivasamudram discharges and those at Bhavani bridge three days later; and Appendix XXVIII being a statement of areas requiring water during the months February to May; and they estimated the limit which they claimed in this season in the event of their former waiver in consideration being set aside, as 9,000 cusecs at Sivasamudram whenever it is in the river.

112. It is not clear to me on what evidence Madras rely to support this estimate. Mysore has put in a statement with My. 13 showing average monthly flow at Sivasamudram based on their old gaugings there, which however are unreliable as they have been found to be in excess of actuals—*vide* Ma. 10 (*a*). Madras apparently do not contest these figures, apart from their suspected excess; but even neglecting the fact that they are probably too high, the figures certainly must be held to bar so high a limit claim as 900 cusecs. Neither, in my opinion, do the figures put in by Madras Appendices XXVII and XXVIII support such a claim

113. A fair and resonable application of the provisions of the Agreement of 1892 to the case of hot weather supplies would appear to me to give Mysore full right in this season to take as much water as they require for their existing channels leaving the residue only to Madras; the two systems of minor channels being, so far as is known, on an equal footing as regards prescriptive right based on the period of user; and there being no limit less than full supply to Mysore's claim for these channels as they existed in 1892.

114. It is in evidence that, from some time about 1904, in order to maintain a certain necessary limit for their power supply at Sivasamudram, Mysore have been obliged to restrict their user of the hot weather supply for irrigation purposes; and from particulars given in the statement of irrigation for channels below the reservoir site, submitted with their letter No. 1428 of 10th February 1914, it appears certain that their hot weather irrigation has in consequence suffered; falling from an average of 2,993 for eight years previous to 1904, to an average of 2,486 for seven years since 1904—a difference of roughly 500 acres.

115. This means that even to maintain a regular supply of 500 cusecs at Sivasamudram, Mysore has had to pass on to Madras more water during the hot weather months than that to which Madras was entitled by prescriptive right under the 1892 Agreement, or had previously enjoyed.

116. Judged in this light, the objection of Mysore to burden themselves in perpetuity, with the obligation of passing on from Sivasamudram 900 cusecs continuous supply irrespective of whether it is required for their power scheme or not, is at least intelligible.

117. It is unfortunate that we have nothing definite to guide us in this matter as to gauges or supplies actually used in the past as we have in the case of the major claim for a limit flow at the Cauvery Dam for the Delta irrigation and all I need say here is that so far as the evidence before the Arbitration goes, it does not satisfactorily fully support the respective claims of either party as they have been defined in event of the admission in My. 7 (78) not being upheld. I must, however, deal with it in my final computation as a specific item of the award; since, while not affecting the Kannambadi Reservoir project as we now have to consider

it, it might, possibly though not probably, give rise to further dispute at some future date, and it is solely on this consideration that it appears desirable and necessary to make it a specific item of the present Arbitration.

118. It remains to consider the evidence as to the point of disagreement which has arisen during the discussion with regard to the "period" of hot weather flow. Madras, generally, in presenting and arguing their case, have referred to it as from March to May. In Ma. 6, paragraph 13, the admission (I use this word in the significance given to it by both parties—*vide* record of Proceedings of 21st July 1913) is made that February is also included. But in their final rejoinder they adhere to February being excluded from the hot weather supply.

119. Mysore have all along contended that February should be included and their arguments on this point receive very strong support from the proposals made in the Metur Project where no irrigation supply for the Delta is provided in that month; though, as already pointed out, the supply for their minor canals stands on quite a different footing to that for the Delta.

120. The statement put in by Madras, Appendix XXVIII, of crops dependent on the channels above the Upper Anicut and requiring water in February, in view of the known seasonal fluctuations in the river supply, does not appear to me to be compatible with the figures of perennial irrigation as distinct from second crop given in Ma. 15 (*a*) which are much more in general accord with those put in by Mysore of monsoon crop and perennial irrigation for channels which are similarly circumstanced.

121. It may be fairly assumed that on channels which receive the bulk of their supply during the south-west monsoon the bulk of the principal crops would be harvested before February, and I cannot regard the evidence put in by Madras in support of their claim to treat the February supply on the basis of the Delta irrigation claim as at all convincing.

Claim by Mysore that the increase in supply necessary for an increase in irrigation since 1890 from channels above the Upper Anicut should not be allowed.

122. This claim is defined in My. 7, paragraph 26, in which on the evidence of Madras Appendix XV, the extent of the increase in the irrigation from the channels above the Upper Anicut since 1890 is shown to be 32,289 acres and the definite claim is made that the supply necessary for this increase in area, estimated by Mysore at 70 mills. c.ft. = 800 cusecs nearly in the south-west monsoon, and at 46 mill. c.ft. = 530 cusecs nearly in the north-east monsoon, should be deducted from the limit supply which under this Arbitration may be fixed as due for the Delta irrigation.

123. In Ma. 12, paragraph 10, Madras admit as correct the area quoted by Mysore as irrigated in 1890; but they deny that this is proof of an increase of 32,000 odd acres in the sense implied by Mysore; they contend that there is no proof that the area irrigable from the channels in question in 1890 or previous to that date was ever intentionally limited to that figure; and they deny that there has been any increase in the mode and quantity of user.

124. In My. 9, paragraph 17, Mysore adhered to the previously defined increase as evidence in support of their claim; and in paragraph 19 they seek to further strengthen it by reference to areas irrigated previous to 1890, the records of which they call for.

125. In Ma. 14, paragraph 33, Madras reply that the inference of Mysore as to the increase is not a fair one. They state that the channels were old ones; and re-affirm their prescriptive claim to full user as in the past irrespective of the area irrigated.

126. In paragraphs 100 and 106 of the same exhibit, Madras, for the first time, raised the question of "command" as regards these channels; in their reply My. 12, paragraphs 76—81, Mysore deal only with this point which I have already discussed in paragraps 105—110. They make no further reference to the original claim now under examination; but, in the summary of their case, My. 16, paragraph 17 (*b*), it is clear that they still adhere to it, and are still hoping that it will be

supported by the complete statistics of areas irrigated prior to 1890 which they await.

127. I do not think that this further information, even if available, which seems doubtful, is likely to help them, in absence of any direct evidence that there has been any material increase since 1890 to the general scope of the channels in question; such for example, as a new channel or head sluice or the enlargement of an old channel, or head sluice for the purpose of extracting from the river, either an entirely new irrigation supply for the irrigation of a tract not previously irrigated, or an increased supply for the extension of irrigation in a tract which would not have been possible without the additions.

128. It is perfectly well known that the development of irrigation on any canal system is gradual; this is amply proved by the history of every canal system yet constructed in India and it is invariably recognised and provided for in the financial forecasts of all new projects. I consider therefore that any extension, up to the full development originally provided for in any scheme, is a matter of right depending, not on the rate of development, but on the date of completion and the scope of the scheme as originally projected.

129. To make my meaning quite clear; suppose, for example, that the canals in question have been constructed before 1870 and that they were projected to irrigate an aggregate of 100,000 acres requiring a supply, say, of 3,000 cusecs, but that up to 1890 with this supply irrigation on them had developed only up to 80,000 acres. Then I consider that, under any fair and reasonable application of the 1892 Agreement, the prescriptive right of Madras to the full supply of the canals would be limited not by the area irrigated in 1890, *i.e.*, twenty years previous to the inception of the present case, but by the supply necessary to develop the irrigation up to the 100,000 acres originally intended and to irrigate which the works were originally designed.

130. What in my opinion might be held reasonably to debar a claim to future supply for increases in the irrigated area since 1890 would be any proved material alteration of, or addition to, the original works or inception of a new work since that date; in which case, I take it, prescriptive right could only be held to have matured under the 1892 Agreement, subject to the usual limitations and with reference to the date of the addition. This view would in fact place these works on exactly the same footing as was accorded to similar works in Mysore by the 1892 Agreement and is consistent with the opinion I have already expressed with regard to the Mysore rights on those channels—*vide* paragraph (128).

131. Now there is no evidence of any alterations or additions such as I have defined to these channels since 1890; and, in the circumstances, while it is clear that there has been gradual development of irrigation on them since that date, it is also clear, if my view is correct, that the development is a matter of right acquired by prescription of user anterior to that date.

132. For these reasons, I do not consider that, in respect of that development, there should be any restriction of the supplies to be awarded as due for the Delta irrigation.

Remission of revenue and deficiencies in crop outturn or value.

133. The bearing on this case of the remission of revenue in the Delta is referred to in the evidence as follows:—

My. 7, paragraph 61; Ma. 12, paragraphs 54 and 55; My. 9, paragraph 54; and Ma. 14, Part IX, paragraph 66.

Initially, Mysore claimed that the small amounts of revenue remitted, even during the worst years, were evidence of sufficiency of supply in the past, and of the sufficiency in comparision therewith of their proposals for the future. Madras in Ma. 12, paragraph 54, pointed out that, not only remissions of revenue, but also loss in crop outturn to raiyats had to be considered which in the worst year was computed at as much as from 70 to 90 lakhs of rupees.

134. It was in consequence of verbal discussion arising from these arguments that the Arbitrator called for more detailed information.

135. In My. 9, paragraph 59, it was pointed out, by reference to Madras Triennial Administration Report for the three years ending 1901-02, that, even in the year of worst supply in the river, a large part of the remission has been due to floods, *i.e.*, to submergence of crops and not to scarcity of supply.

136. Ma. 14, Part IX, paragraph 66, contests this view, and points out that much of the revenue remissions and loss of crop outturn formerly attributed to submergence was, on futher examination, found to be really due to the backward state of the crops occasioned by scant supplies early in the season, rendering them more liable to damage from submergence than they would have been, had the early river supplies been better.

137. Finally, in Ma. 20, Madras put in a general review of the remissions of revenue and losses in crop outturn for the twenty years 1890-91 to 1909-10.

Statement table II shows total revenue remissions for this period in round figures at 14 lakhs of rupees, of which 8 lakhs are due to deficient supply, and six to submergence or floods.

Table V shows the estimated loss to raiyats in the ten years from 1901, that due to short supply being estimated at an average of no less than 40 lakhs per annum, while loss from floods is estimated at an average of some 25 lakhs per annum for the same period.

In Ma. 20, paragraph 8, it is further pointed out that the method of computation adopted is likely to exaggerate the latter figure.

138. Now, quite apart from the many assumptions, not clearly based on ascertained facts, which have been made in the computation, I may point out that the general conclusion arrived at, conflicts with the general description of the Tanjore Delta irrigation, given in the *District Gazetteer*. Extracts from this are given in A-7, 79—81, from which it is clear not only that the loss from floods was considered by the authors of the *Gazetteer* the most serious drawback, *vide* extract from pages 147 and 149, but also, that, in 1884, the worst flood year, see also diagram Ma. 9, no less than a lakh of rupees out of the total of 6 lakhs remission was granted for *scarcity of supply due to breaches in the canal caused by the floods*; so that it would appear that the flood remissions should sometimes be enhanced by part of the remissions granted for scarcity; and there is at least as reasonable ground for supposing that the scarcity remissions should be reduced on the ground of being partly due to breaches caused by floods, as for supposing that the contrary is generally true, as suggested by Madras.

139. Quite apart from this, it is open to question whether all remission for loss of crop, except that specifically due to submergence, can reasonably be attributed to scarcity of irrigation supply. Are insect pests and other diseases affecting crop outturn unknown in the Delta? Bulletin No. 67 issued by the Agricultural Department of Madras is a sufficient answer as to insect pests; and there may be other diseases affecting the Delta rice crop, though I have not yet been able to obtain any Bulletin on this subject from the Revenue Library. Again, is the crop outturn unaffected by such natural causes as hot winds and unusual dryness of the atmosphere? Or by such artificial cause as bad seed, careless cultivation or untimely harvesting, which may be due to scarcity of labour or to epidemic sickness? Extract A-7, 79, shows that labour conditions in the district have been adversely affected in recent years by emigration specially, and it is significant that the year 1893 in which there was a marked drop in area was an unusually unhealthy year in Tanjore district—*vide* the mortality statement in the *Gazetteer*.

140. On all these considerations I am unable to advise acceptance of the general conclusions of Madras as to the estimated effect on the crop outturn of scarcity of supply. I see no reason to suppose that what is admittedly one of the richest districts in Madras has suffered from this cause to the extent shown by the figures advanced. But even if these figures could be accepted, is it to be supposed that Madras seek to establish, on behalf of the Tanjore raiyats, prescriptive right to an annual crop loss of 40 lakhs?

141. There is in my opinion nothing in the evidence to show that the facts regarding the irrigation in the Delta, and the risk of loss by floods being its most

serious menace, are not in general accord with the description given in the *Gazetteer*, to which I have referred; it must be accepted that the supplies and the regulation of those supplies by the Madras Engineers in the past, have resulted in making the Tanjore Delta the prosperous tract it is; and, provided always that the supplies necessary for irrigation which have been enjoyed in the past are secured in future, there can be no risk of any prejudice to the admittedly very important interests involved.

Sir John Benton's opinion.

142. Sir John Benton, in his official capacity as Inspector-General of Irrigation in India, had recorded his opinion on the Mysore proposals for the Kannambadi Reservoir in a note, dated 12th May 1911, long before this Arbitration commenced, and both parties have, from time to time, during the Arbitration proceedings, referred to certain opinions or statements recorded by him which they considered might be held to support their respective views.

It is only natural that they should have made such appeals to the opinion of an officer of Sir John Benton's expert experience, great reputation and high official standing.

143. In Ma. 9 (42) Madras call special attention to the note; and while they state that they rely on facts as to their prescriptive rights, rather than on any expert opinion, they admit Sir John Benton's impartiality, and the value of his note as throwing much valuable light on the case prior to Arbitration.

144. Mysore refer in My. 7, paragraphs 63 and 64, to the figures given in Appendix V and VI of Sir John Benton's note in support of their own proposals as to the supply necessary to secure the rights of Madras irrigation and in order to show that those of Madras are excessive.

145. It is perhaps unnecessary for me to follow in detail the further argument of either party as it developed on this point. Briefly, it was found that, owing to clerical errors in the computation of the figures from the Madras Annual Revenue Reports, from which Sir John Benton derived his information, all the figures given in column 10, Appendix V of his note, were unreliable; and although the investigation which led up to and followed this discovery took up a great deal of time, it is satisfactory that the error was eventually traced to its source. The explanation and corrections made in Ma. 19 have completely cleared this matter, and have established beyond question the unrealiability of the figures referred to in Sir John Benton's Appendix V; it is clear from his note that he himself suspected them.

146. Again, the figures given in Appendix VI of Sir John Benton's note of the supplies actually used by Madras are admittedly based on the limit gauge of 7·0′ claimed by Madras, and it is clear that Sir John Benton accepted this claim without question. But it is also to be remembered that this limit gauge is one of the crucial points which it is the duty of this Arbitration to determine from facts. Sir John Benton had none of the detailed evidence on this point which the present enquiry has elicited to assist him in coming to a conclusion on the merits of the claim, and, therefore, his *ex-parte* acceptance of it has no value as evidence one way or the other.

147. In considering Sir John Benton's views, as they may affect this Arbitration, I do not think there is any need to go behind, or beyond, the conclusions which he himself formulated, in paragraph 32 of his note, Exhibit Ma. 8-*a*.

148. A perusal of this seems to me to show very clearly that Sir John Benton thought the Kannambadi scheme feasible, without injury to Madras, whose rights he certainly did not underrate. The only misgiving he appears to have had regarding the scheme was from the point of view of Mysore, as he considered that the reservoir should be built of larger capacity than projected, in order to secure it against partial failure in years of unusually low rainfall.

149. It is premature at present to consider the soundness of these views of Sir John Benton as tested by the evidence before the Arbitration.

Consideration of various statements of irrigation supplies actually passed or calculated on limits suggested as adequate by either party.

150. Several of such statements and estimates are in evidence and the following list will serve as a convenient reference to them :—

(*a*) Sir John Benton's estimate of supply actually used based on Irrigation Reports.	Appendix V of his note, Ma. 8-*a*.
(*b*) Sir John Benton's estimate of supplies required based on the 7·0′ limit as a necessary limit.	Appendix VI of his note, Ma. 8-*a*.
(*c*) Annual discharges of Cauvery and Vennar from Administration Reports.	Madras Appendix XVII.
(*d*) Statement computed by Madras for purposes of showing that practically the whole of the above supplies in (*c*) were under the rules intentionally passed for irrigation.	Madras Appendix XVIII.
(*e*) Tables for annual discharges for Cauvery Dam referred to 1909 curve under various assumed limit gauges and of combined discharges Cauvery and Vennar under various assumed limits.	Madras Appendix XXIV.
(*f*) Supplies that would have been passed for irrigation for years 1890-91 to 1909-10 under rules for varying limits proposed by Mysore as sufficient.	My. 7, Appendix F, column (5).
(*g*) Supplies that would have been passed for irrigation for years 1890-91 to 1909-10 under Mysore alternative proposal for uniform 6·0′ limit gauge.	My. 7, Appendix G.
(*h*) The figures of supplies estimated as necessary for the delta irrigation in the Metur Project : these are very conveniently referred to limit gauges in Ma. 9 (25) and are also to be found in Volume I, section II, page 12 of Metur Project.	

It may be noted that the abstract of totals of the Mysore exhibits, (*f*) and (*g*), are incorporated in the Madras exhibit (*e*) and that this exhibit also contains the figures under (*b*).

151. I have already shown that the figures under (*a*) are unreliable and there is no need to notice them further.

The figures under (*b*) represent the results of calculations, made by the Madras Engineers who framed the Metur Project, of supplies actually passed for irrigation in past years subject to their assumed limit gauge of 7·0′ Cauvery Dam and in consideration of which together with other facts they based their estimate of necessary supplies to be provided for in that project referred to in (*h*). They are of course open to question in the matter of the arbitrary assumption of a limit gauge of 7·0′ which under the rules was not the fixed limit previous to 1896.

The figures under (*c*) and (*d*) are open to question on the very important point as to irrigation and flood regulation which I have dealt with in paragraphs 28—41.

The figures in (*e*), (*f*) and (*g*) are all to be taken as subject to the remark as to arbitrary assumptions of limit gauges which I have made under (*b*).

152. It is necessary to note here that all calculations of supplies which are based on the records of the Cauvery Dam gauge reading have been made from the Madras curve of 1909 which was not in existence for any but the last year of the period considered. I have already given my reasons (paragraphs 9 to 12) for accepting this as the most reliable reference for all purposes of examination of the actual effect of rules and regulation in the past, as distinct from intention, and Mysore also have accepted this in their calculations.

153. Before proceeding to consider these various exhibits in further detail it will be as well to examine how far a variation in the limit gauge is likely to affect the supply. For this purpose I have calculated what would have been the effect on

irrigation supplies under limits of 7·0′ and 6·2′ on the Cauvery Dam gauge for six selected years. I must ask that the assumptions made for the purpose of this examination may not be taken as any indication of my final opinion as to the limit gauges necessary or due to Madras under the award. The difference in supply connoted by a limit gauge of 7·0′ = 26,500 and 6·2′ = 20,325, taken from the 1909 curve, is 6,175 cusecs, which represents a reduction on the 7·0′ supply of 23 per cent. I compare the difference in monthly supplies run under assumptions of the 7·0′ limit and of the 6·2′ limit based on the recorded gauge reading for the months June to December in the following table :—

Year	Total supply due to 7·0′	Percentage of reduction due to limit gauge of 6·2′							Total of seven months
		June	July	August	September	October	November	December	
1	2	3	4	5	6	7	8	9	10
	M.c.ft.	Per cent	Per cent	Per cent	Per cent	Per cent		Per cent	Per cent
1890 ...	201,209	...	7	6	...	4	...	...	4
1896 ...	310,678	12	12	13	4	5	...	10	8
1899 ...	157,199	7	9	...	6	...	...	...	5·4
1904 ...	216,300	6	23	13	1·5	...	...	...	12
1905 ...	175,636	0·5	18	8	...	1	...	...	7·5
1908 ...	197,762	...	17	17	10	...	...	...	9·7

154. It will be clear that the supplies would be affected most in the years in which the total supply is highest, *i.e.*, in years in which the lowest limit gauge considered would be oftenest exceeded and consequently the years of lowest supply are those which would be affected least. My only object in making the foregoing comparison is to point out that the proportionate reduction in total or monthly supply is not at all proportionate to the reduction in the limit gauge as might have been supposed.

155. I now proceed to examine the evidence as to the effect on the irrigation in the past of the 7·0′ limit claimed by Madras with a view to ascertaining if there is anything which can be held to support that claim as essential to the conservance of their irrigation in future. This may be done in two ways, first, by a comparison of the annual supplies, which they would have enjoyed, and claim to have enjoyed, under the 7·0′ limit, with the areas annually irrigated, and secondly, by a comparison of the number of days the 7·0′ limit was attained in each year, with the areas irrigated. In this examination I accept for reasons given in paragraph (12) the Madras curve of 1909 for the computation of quantities.

156. Appendices A.E. XI and A.E. XII show actual variations in annual irrigation supplies based on the 1909 discharges and the 7·0′ limit and in the areas irrigated in each year for twenty years from 1890-1909; these are brought together for comparisom in Appendix A.E. XIII.

The following points are noted.

157. In seven years of the twenty, a deficient supply, *i.e.*, a supply below the average, coincided with an increase in area, *i.e.*, with an irrigated area above the average. In seven years, an increase in supply coincided with a decrease in areas and in one other year, with an average area.

In only three years out of the twenty, did the increase in supply coincide with an increase in area and, in only two years, did a decrease in supply coincide with a decrease in area. The best year 1892 with a deficiency in supply of 2·76 per cent gave a record area 2 per cent in excess of the average, the next best year 1890 with a large deficiency in supply of nearly 20 per cent gave an area very nearly as good as 1892, *viz.*, 1·8 per cent in excess of the average. The group of three best years 1890, 1891 and 1892 all gave increases in areas with supply below the average.

In 1896 and 1898 very considerable increase in supply of over 20 per cent gave decreases in area of about 1 per cent.

In 1905 and 1908 very considerable decreases in supply of 20 per cent gave increase in area of from 0·5 to 1 per cent. In the worst year 1899, a very large deficiency of nearly 40 per cent in supply gave a decrease in area of only 4 per cent.

158. The foregoing examination of the evidence under the first head, perhaps, renders unnecessary a complete detailed examination under the second head. I have therefore selected for comparison only six typical years including the four years in which the areas irrigated were lowest in the twenty years period.

159. The total number of days the 7·0′ gauge was reached in those six years, are compared with the irrigation variations in Appendix A.E. XIV. It will be noted that in 1890, 1905 and 1908, when there were increases in irrigation areas, the number of days the 7·0′ limit was reached was appreciably less than in 1896 when the area was below the average and than in 1904 when it just equalled the average.

In 1896, when the number of days the 7·0′ gauge was reached was greatest, there was a decrease in area.

In 1899, only, the worst year of all, is the lowest number of days coincident with a decrease in area and that not proportionately large.

160. From this examination of the evidence under both these heads, I find myself unable to advise the Arbitrator that the Madras claim for a 7·0′ limit gauge at the Cauvery Dam throughout the irrigation season tested by the effect it can be shown to have had on the irrigation in the past, can be accepted as having been proved to be essential to the conservance of their irrigation in future.

161. The next point for consideration is one on which a good deal of stress has been laid by Mysore, *viz.*, the support given to their estimates of the supplies necessary to conserve the Madras irrigation unimpaired by those calculated as necessary both for the Cauvery and Coleroon by the Madras Engineers in framing the Metur Project.

162. Madras contend that the calculations made for the Metur Project were obviously applicable to a regular supply completely under their control and therefore absolutely secure from seasonal fluctuations; also, with regard to the Coleroon irrigation, that the framers of the Metur Project were not so fully acquainted with its conditions and requirements as their representative in the present case has become now, that his attention has been specially directed to it in the course of the Arbitration proceedings.

163. I have already shown that the specific claim of 644 mills. cubic feet which Madras have put in on behalf of their Coleroon irrigation is not supported by the evidence, while examination of the Metur Project Records, Volume I, section (ii), paragraph (50) and connected matter shows conclusively that the Coleroon irrigation had been taken into account when fixing the supplies judged necessary under the conditions contemplated by the Madras Metur Project, which project, it is necessary to state, has received the official approval of the Madras Government in submitting it to the Government of India recommended for sanction.

164. Now I have already alluded to the general irrigation practice of allowing a certain percentage generally taken as 25 per cent over and above a normal supply in order to meet the exigencies of a fluctuating supply. I have also shown that this principle has been recognised and made effective by the framers of the Madras rules for regulation of their irrigation supplies in the past—*vide* paragraph 26. The principle has also been admitted by both parties to this Arbitration.

165. Turning now to Ma. 9 (25), it will be seen that the provision in the Metur Project for a steady supply month by month, column (5), compares very favourably with the figures given in column (4) of actual averages enjoyed in the past under a fluctuating supply and subject to an assumed 7·0 feet limit, and there can be no doubt as to the wise caution on the part of the Madras Engineers evidenced in estimating the figures proposed in column (5) for constant supply; and the addition of 30 per cent (instead of the usual 25 per cent) to those figures in order to arrive at limit gauges for a fluctuating supply given in column (6) in pursuance of the principle I have just alluded to will also appear reasonable when compared either with the figures given in column (5) or with the past actuals in column (4).

165.-A. It might possibly be held that the figures in column (5) of the table, owing to an oversight, did not include specific supplies for the French irrigation amounting to about 27,000 acres. A proportionate allowance for this area, which is only about $\frac{1}{3\,8}$th of the area for which specific allowance has been made in arriving at the gauges in column 5, would affect them very little, for example, the supply read from Madras curve for the 6·0′ gauge, if increased by $\frac{1}{3\,8}$th, would only be increased by about 500 cusecs, equal to a rise of rather less than 0·05′ on the gauge. Moreover, it is clear from all the evidence that there never has been any specific supply for the French irrigation taken in at the Cauvery Dam or the Cauvery regulator; they have always been dependent in the past on the surpluses of the head supplies taken in at those works according to the rules and the operations of regulation under the rules, which were left over after the abstraction from the head supplies of the supplies necessary for the Madras irrigation above them; such surpluses they must always continue to receive in future. A comparison with the figures, column (4), of actual supplies estimated with an assumed 7·0′ limit with those of column (6) affords, in my opinion, a very sufficient guarantee that with the limit gauges of column (6) French irrigation cannot possibly receive less than it has received in the past.

On the contrary, if the existing rules of 1905 prescribing a 7·0′ limit for the Cauvery Dam whenever it is in the river are adhered to, it is clear that French irrigation should in the future receive larger shares of river supplies between the 6·0′ and 7·0′ gauges on the Cauvery Dam than it was accustomed to receive under the older rules preceding the remodelling of the Upper Anicut in 1902.

166. It is to be borne in mind that the actuals in column (4) are based on an assumed 7·0′ limit, as though this had always been utilised for irrigation purposes whenever available, whereas, as I have shown in paragraphs (83) and (84), it was never intended by the framers of the rules to be so utilised and in point of fact was not so utilised previous to 1902; hence the figures in column (4) obviously err on the high side so far as intention is concerned. And remembering that the rules of regulation and their operation in practice previous to 1896 gave actual supplies at the Cauvery Dam varying from 6·5′ to 6·0′, for normal, and from 7·0′ to 6·5′ for special periods, it is at once obvious that, if the supplies available in the past under the operation of the rules have sufficed for the irrigation requirements, the provision of the supplies in column (6) should fully meet the requirements for the conservance both of the Madras and French Delta Irrigation in future. That the Madras Government also take this view is clear from the evidence in the present case, seeing that, although the omission of the French irrigation from the Metur Project figures, column (5) of the statement Ma. 9 (25), was known before these proceedings commenced, they have obviousiy considered necessary supplies to the French irrigation to be covered by the 7·0′ limit which is their claim for the purpose of this Arbitration.

167. It is impossible therefore to consider the proposals by Mysore, column (2) of that statement, as in any sense an unreasonable estimate of the Madras requirements.

168. In order to examine the effect of limit gauges on the incidence of monthly supply and on irrigation, I have prepared the statements Appendix A. E. XV and A. E. XVI for six selected years; I compare monthly supplies actually run for irrigation subject to the assumed limit gauges of 7·0′ and 6·2′, respectively, with the monthly supplies calculated as necessary in the Metur Project. In both cases the figures are taken to the nearest 1,000 mills. cubic feet.

The Metur Project figures are taken from the table, Volume I, section II, page 18 of the Project report; they include supplies estimated as necessary both for the Coleroon and for the Cauvery Delta proper.

169. The years selected for examination are 1890, an admittedly very good year in which the area irrigated was above the average, one of the very best in fact, and supply below the average with no remissions of revenue; 1896, a year in which supply was above the average and area rather below the average also with no remissions, the year 1899, the worst on record for short irrigation and remissions for short supply affecting harvest, and 1904, 1905 and 1908 being all years in which supplies were considered to be unsatisfactory and in all of which

remission had to be given. Concise notes as to supply, area and remission are given under each year figures.

The statements show also the proportions, the monthly supplies actually run under the assumed limit gauge bear to the standard estimated requirements, differences being shown in percentages *plus* or *minus* of the standard.

170. The results are very interesting and the following points are noted:—

Results in the best year from an irrigation point of view 1890 are the nearest approximation to the standard supplies, those with the assumed limit gauge of 6·2′ being closer than those with that of 7·0′.

The change of assumed limit gauge makes comparatively little difference to the results ; in only three months August 1904 and July 1905 and 1908 are there changes in the algebraic sign of the percentages.

171. Looking at the tables generally, one cannot help noting that areas appear to depend almost entirely on the aggregate supply of July and August, while quality of the crop as gauged by remission depends on supplies in September to December; there were no remissions in 1890 and 1896 when supplies in the latter months were generally normal or above normal ; but in all years in which remissions were granted, supplies in those months were generally and often very considerably below normal.

In 1890, even a considerable defect in July supply had no effect in reducing the area ; and in 1896, very large increase in supply in both July and August did not lead to a full area.

And finally, differences in the supplies and percentages for the two limit gauges are least in the worst year of all, 1899, many of them being unaffected; this of course was foreshadowed in paragraphs 153 and 154.

172. I think the result of these comparisons is generally to show that the limit gauge is not of quite so much importance as might have been expected, though I do not suggest for a moment that, on this account, there should be any reduction in the limit gauge which is proved to be due to Madras under her prescriptive right of user.

173. But the most important point of all is that, as noted in paragraphs (96) and (102), the assumption of any limit gauge whatsoever for the purpose of estimating irrigation supplies utilised is not and never can be a true measure of supplies actually run in the channels which must still continue to carry their share of flood water. And in this peculiarity of the Cauvery and Vennar channels, we have not only an important and inherent element of doubt as to what exact proportion of the flood supplies has been and will in the future be actually useful for irrigation, but also an inherent and most valuable safeguard against any small error in the matter of fixing a limit gauge which might otherwise lead to undue reduction of supplies actually necessary, seeing that it would be automatically corrected by the flood regulation.

174. Turning now to the gauge records of the Cauvery Dam given in Madras Appendix VI, we find that in the worst year 1899 more than the standard supply in June would have been secured under either of the limit gauges assumed.

In July when under the 7·0′ limit the deficiency was 11 per cent and under the 6·2′ limit, 19 per cent, there were 8 days on which the Cauvery Dam gauge was over the higher limit and 15 days on which it was over the lower limit ; and the automatic adjustment due to extra supplies in the river over the limit gauges, on the assumptions as to proportions assumed in the illustration given in paragraph 102, and under the principle therein demonstrated, would have given extra supplies over and above the supply received under the limit gauges as follows :—

Under the 7·0′ limit 49,045 cusecs = 4,260 m.c.ft., under the 6·2′ limit 87,000 cusecs = 7,630 m. c. ft. which increment would have raised the supplies obtained to—

M. C. FT.	M. C. FT.
46,000	41,000
4,260	7,630
50,260	48,630 cusecs,

respectively. These are so close to the standard limit required that I do not think the shortage in area could in any way be attributed to the July running, especially as from these calculations it is clear that the actual supplies received as shown by the Cauvery Dam gauging would have been about 55,000, or rather more than the standard required.

In August there was only one occasion on which the lower assumed limit was exceeded when the automatic replenishment would have been 400 cusecs for one day = 32 mills. cubic feet only.

It is, I think, quite clear that the comparatively low area obtained in that year was due to the low August supplies in the river, which would not have been affected by impounding under either of the assumed limits. In September, the automatic increments would have amounted to 700 mills. cubic feet and 2,400 mills. cubic feet and the supplies obtained would have amounted to—

M. C. FT.	M. C. FT.
40,000	38,000
700	2,400
40,700	40,400

The supplies actually run as per gauge records would amount to about 42,000 mills. cubic feet, and it is clear that even this extra supply over and above the standard did not admit of recovery of the short cropped areas due to the August deficiencies.

In no other months in the year would the supply have been affected under either limit as is shown in the table.

175. There is, I think, no necessity to follow this investigation in detail further. By analogy from what I have shown was the effect of extra supplies in 1899—1900 and with the aid of the Madras Appendix VI we can determine by inspection the following results in the other bad years.

In 1904 under either limit gauge there would have been no deficiency at all in the two months affecting area. In the other months, the deficient supplies would also have been unaffected.

In 1905 the standard would have been attained under either limit in July, but not in August when the difference would have been very small. As more than a full area was obtained in that year, it is clear such difference would not have mattered. Other months would have been very little affected.

In 1908 the standard would have been reached under either limit for July and August and other months not affected.

176. The conclusion I come to from this examination of the case is that impounding at Kannambadi under any limit gauge which it is at all possible to fix under consideration of the rules and regulations, and which, I think, must lie somewhere between the limits I have chosen for the purpose of this examination, will not prejudicially affect irrigation in the Delta in the bad years and that *a fortiori* it cannot prejudice it in good years.

Consideration of relative merits of a fixed limit gauge or a varying limit to suit the estimate of varying requirements.

177. For a varying limit gauge I do not think that it would be safe to go below the limit gauges in column (6) of the table given in Ma. 9 (25); they are based generally on a limit gauge which would give a supply 30 per cent in excess of normal daily full supply estimated as required for each month's irrigation. This is, I consider, not too high an addition to allow in the event of a varying limit being adopted. I think, however, from my foregoing examination of typical years, that there is no necessity for or object to be gained by a varying limit for July and August. It would be simpler and equally efficient to accept 6·7′ as the limit gauge necessary for both these months. Similarly, for September, a limit of 6·0′ would, I think, be preferable to the varying limits given in the table and for June 3·5′, for October 5·2′, November 4·3′, December 3·0′ and January 2·5′ as in the table.

For convenience of reference I recapitulate the limit gauges proposed with the equivalent volumes the gauges connote as read from the Madras curve of 1909 as follows:—

Month.	Limit gauges taken from column 6 of Ma. 9 (25) but modified as suggested by Assessor.	Corresponding supply read Madras curve of 1909. Cusecs.
June	3·5	5,400
July and August	6·7	24,250
September	6·0	18,770
October	5·2	12,760
November	4·3	7,530
December	3·0	4,200
January	2·5	3,000

The volume in each case is to be considered as of the essence of the intention and not the gauge.

I do not think that there would be any risk to the Delta irrigation interests if these modified limit guages were adopted and provided that the river supplies were adequate, they would without doubt amply ensure the necessary supplies in each month.

178. There are, however, certain periods in certain years in which the general range is much lower than the normal, and it is impossible to say that, in such periods, a supply bigger than the limits suggested for the varying scale would not be beneficial. For example, the latter half of November 1897—98; the whole period October to December in 1899—1900; November 1900—01; October and November 1904—05; not to mention others.

The fact that such higher floods did not actually occur in those years, cannot, of course, be taken as a proof that they could never occur during similar periods, and it is clear that if they did they would probably be useful and beneficial to the irrigation.

179. On these grounds, I think there can be no dispute on the basis of the 1892 Agreement as to the right of Madras to claim a fixed limit guage throughout the irrigation season, June to January, if they wish to adhere to that claim; though I believe they would be running no risks whatever in voluntarily accepting the sliding scale proposed. I would suggest leaving the option of choice in this matter to them.

Protests by Tanjore and the French Government against the construction of the Reservoir.

180. While these have not been put in by either party as evidence bearing on the Arbitration, it is perhaps desirable that I should here notice them.

Kannambadi Reservoir, if allowed, can only intercept the supply from some 4,000 square miles out of a total catchment area at the Cauvery Dam of some 26,000 square miles—and in any case, therefore, it can only affect a part of the total supply of the Delta, while no impounding can be allowed which would restrict the Delta irrigation supplies below the quantity found to have been used in the past and to be necessary for its conservance in future.

181. The Madras claims are by prescriptive right to a full and ample supply for the Delta irrigation, and it is in the nature of an essential principle that the award given in this Arbitration shall be such as to conserve those rights unimpaired. The supplies which Madras claims as having been enjoyed in the past include the French territory supplies which have always been passed on from the Cauvery system as I have shown in paragraphs 165-A and 166 and also Part I (7) and it is the supply actually used inclusive of this that must be taken into consideration in determining what quantity is necessary in future.

182. As to the Tanjore objections, which are based largely on the suggestion that the ryots know better than the Madras Government as advised by their Engineers what are the requirements of the Delta, it may be pointed out that, under the

past administration of the Cauvery Delta supplies by the Madras Government, the areas irrigated have risen as follows:—

Year.	Acs.
1830	547,000
1837	668,000
1846	705,000
1866	846,000
1880	900,000
1892	915,000

I have been unable to obtain figures for years previous to 1866 for the Coleroon irrigation, but the diagram Ma. 9 shows that this too has gradually improved since 1866 though not to the same extent.

183. It was under the operation of the rules and regulation of 1882, Cauvery Dam and 1893, Cauvery and Vennar regulators, that the combined Cauvery and Coleroon irrigation reached its zenith; the years 1882—1892 taken as a group are the best decade in the history of the Delta, while they also contain the two highest record years, 1890 and 1892. It is to the supplies used in these years as well as to those necessary in the worst years that most careful attention must be given when determining the supplies necessary to conserve all the Delta irrigation rights unimpaired.

184. I trust that this brief statement of the salient facts relating to this Arbitration will allay any apprehension which has been entertained with regard to it by those concerned.

Estimate by the Assessor of supplies due to Madras which are suggested for the consideration of the Arbitrator for the purpose of his award.

185. The finding of the Arbitrator on the interpretation of the Agreement of 1892 makes it clear—

(1) that, in estimating the supplies due to Madras as necessary for the full conservance of its prescriptive rights, the essential criterion must be the supplies which can be shown to have been necessary and actually utilised in the past;

(2) that the estimate should not fall short of what can be shown to have been necessary in the past, even though the rules and regulation under which the supplies were obtained can be shown to have been based on misconceptions or ill-founded opinions of responsible officers;

(3) that the intention of all concerned in the administration of the supplies in the past must be held to have been the full development of the irrigation of the tracts the existing works were disigned to irrigate, and that supplies necessary for that full development are to be secured as an essential part of the prescriptive right if this has matured since the works first came into operation;

(4) that supplies which cannot be shown to have been necessary for irrigation even though they can be shown to have been actually passed through the works in the past under misconception or ill-founded opinion as to their necessity, are to be excluded from the estimate;

(5) and, finally, that avoidable waste is to be excluded from the estimate.

NOTE.—At the request of the Madras Representative, I add a note explaining exactly what I mean by the words "avoidable waste" in this paragraph.

I mean water formerly passed down any given channel owing to recognised defects in the Madras works which water cannot be shown to have been necessary for their irrigation, and the passing down of which is now no longer necessary owing to the defects in the works having been remedied. For example, the water formerly passed into the Coleroon over the Upper Anicut before the Upper Anicut was remodelled, which water cannot be taken to have been necessary for the Coleroon irrigation.

186. I accordingly base my estimate of the volume of water and the limit gauge measured at the Upper Anicut, Cauvery Dam gauge, due to Madras by prescriptive right under clause (2) (*b*) of the issues on the following calculations:—

	From Madras curve 1909.	
(1) Under rule (1) 1882 Upper Anicut rules.		
Normal supply higher limit 6·5′	22,750	cusecs.
lower limit 6·0′	18,750	,,
Total ...	41,500	cusecs.
(*a*) Mean ...	20,750	,,

Special supply higher limit 7·0′	26,500	cusecs.
lower limit 6·5′	22,750	„
Total ...	49,250	„
(*b*) Mean ...	24,625	„

The mean of (*a*) and (*b*) supplies obtained under normal and special conditions will be:—

(*a*) =	20,750	
(*b*) =	24,625	
Total ...	45,375	cusecs.
Mean supply ...	22,687	„

(2) Under rule (2) Cauvery and Vennar rules of 1893 normal supply required was—

	17,344	cusecs.
Add—25 per cent which I consider a fair and reasonable allowance for a fixed limit, if applied to the whole season	4,446	„
	21,790	„
Add—for escape over Calingulah for Coleroon	1,030	„
Total ...	22,820	„

(3) From quantities estimated as necessary for July and August, Metur Project, Volume I, section II, page 18—

Total required for July	51,669	m.c.ft.	
for August	47,461	„	
Total for 62 days ...	99,130	„	
Mean per day ...	1,598 mills. c.ft. or	18,377	cusecs.
Add—25 per cent which I consider a fair and reasonable allowance for a fixed limit, if applied to the whole season		4,594	„
Total ...		22,971	„

187. Under the interpretation by the Arbitrator of the Agreement of 1892 and in consideration of these three calculations, I suggest for consideration of the Arbitrator that, for a fixed limit, if applied to the whole irrigation season, 6·5′ on the Cauvery Dam, which, as read from the Madras curve of 1909, is equivalent to a discharge of 22,750 cusecs, will fully safeguard the prescriptive rights of Madras and will secure in the future the full irrigation supplies she has enjoyed in the past.

In case of any deviation in this discharge for the 6·5′ gauge such as may from time to time occur owing to changes either in the works, or in the channel conditions, the volume shall be considered as of the essence of the award and not the gauge.

The award of this limit volume and gauge shall be held to apply to the irrigation period extending from 1st June until the end of January in each year or, as suggested in paragraph 179, Madras may be given the option of adopting instead of the fixed limit gauge and volume herein suggested for the whole season, the varying limit gauges and volumes as defined in paragraph 177.

188. For the hot weather supply to be awarded under this Arbitration, I suggest, for the consideration of the Arbitrator, that the Mysore Government shall be required to pass on from Sivasamudram a minimum limit of 900 cusecs constant supply. The award of this volume shall be held to apply to the irrigation period from 1st February to 31st May in each year.

M. NETHERSOLE,
Assessor.

23rd February 1914.

ADDENDUM

TO ASSESSOR'S EXAMINATION OF EVIDENCE ON ISSUE 2 (*b*).

Explanatory note as to the meaning of certain words used by the Assessor in his Examination of the Evidence put in at the request of the Madras Representative.

At the proceedings before the Arbitrator on the 24th February 1914, I was asked by the Madras Representative to explain exactly what I mean by the words "officially accepted and effective opinion," which I used in paragraph 97 of my Examination of the Evidence in reference to flood regulation, which matter was more fully discussed in my paragraph 30 *et seq.*, and I promised to give my explanation in writing.

2. In order to make my meaning perfectly clear, it will be convenient to take the specific example of which I was then writing.

(1) The opinion on the subject of flood regulation and its effect on irrigation supplies by Major Montgomerie forwarded for consideration of the Chief Engineer with his letter, dated the 14th February 1881, was what I mean by an "official opinion."

(2) The extract A-7 (78) from the Chief Engineer's note, dated 9th June 1881, on Major Montgomerie's report, shows that Major Montgomerie's opinion was accepted by the Chief Engineer and it then became what I mean by an "officially accepted opinion."

(3) The sanctioning of the Upper Anicut rules of 1882 formally approved by the Chief Engineer on 19th February 1882 shows that the "officially accepted opinion" was in due course made "effective" in the rules, and this is precisely what I mean by an "officially accepted and effective opinion."

3. The only assumptions made by me in this explanation are:—

(1) that the Chief Engineer, when he formally sanctioned the rules of 1882, had not changed the opinion he had so recently officially accepted; and

(2) that the rules had been framed in accordance with that opinion.

4. The logical connection which I have shown (paragraph 30 *et seq.*) to have existed between the 1882 rules of the Upper Anicut and of the 1893 rules for the Cauvery and Vennar Regulators, after they were remodelled, proves that, in framing the 1882 rules, the officers responsible for them were not labouring under any essential misconception as to the supplies they were dealing with.

5. And, finally, the effect of the operation of the rules as evidenced in the records of the irrigation at that period, to which I have referred, paragraph 43, proves that the "officially accepted and effective opinion" on which the rules were based was not ill-founded.

M. NETHERSOLE,

26th February 1914. *Assessor.*

APPENDIX A.E. I.

General Map of Cauvery catchment.

(Not reproduced.)

APPENDIX A.E. II.

Comparison of Montgomerie's calibration of Cauvery Dam gauge with that made in 1909.

Cauvery Dam north gauge readings	Discharge		Cauvery Dam north gauge readings	Discharge	
	Montgomerie's curve	Madras curve		Montgomerie's curve	Madras curve
	CUSECS.	CUSECS.		CUSECS.	CUSECS.
0·1	.....	40	4·6	5,720	8,760
0·2	.....	80	4·7	6,290	9,370
0·3	.....	120	4·8	6,860	9,980
0·4	.....	160	4·9	7,430	10,590
0·5	.....	200	5·0	8,000	11,200
0·6	.....	310	5·1	8,750	11,980
0·7	.....	420	5·2	9,500	12,760
0·8	.....	530	5·3	10,250	13,540
0·9	.....	640	5·4	11,000	14,320
1·0	.....	750	5·5	11,750	15,100
1·1	.....	850	5·6	12,660	15,830
1·2	.....	950	5·7	13,570	16,560
1·3	.....	1,050	5·8	14,480	17,290
1·4	.....	1,150	5·9	15,390	18,020
1·5	.....	1,250	6·0	16,300	18,750
1·6	30	1,420	6·1	17,440	19,550
1·7	60	1,590	6·2	18,580	20,350
1·8	90	1,760	6·3	19,720	21,150
1·9	120	1,930	6·4	20,860	21,950
2·0	150	2,100	6·5	22,000	22,750
2·1	200	2,280	6·6	23,100	23,500
2·2	250	2,460	6·7	24,200	24,250
2·3	300	2,640	6·8	25,300	25,000
2·4	350	2,820	6·9	26,100	25,750
2·5	400	3,000	7·0	27,500	26,500
2·6	500	3,210	7·1	.....	27,850
2·7	600	3,480	7·2	.....	29,200
2·8	700	3,720	7·3	.....	30,650
2·9	800	3,960	7·4	.....	31,900
3·0	900	4,200	7·5	.....	33,250
3·1	1,080	4,440	7·6	.....	34,600
3·2	1,260	4,680	7·7	.....	35,950
3·3	1,440	4,920	7·8	.....	37,300
3·4	1,620	5,160	7·9	.....	38,650
3·5	1,800	5,400	8·0	.....	40,000
3·6	2,010	5,640	8·1	.....	41,500
3·7	2,280	5,880	8·2	.....	43,500
3·8	2,520	6,120	8·3	.....	45,000
3·9	2,760	6,360	8·4	.....	46,000
4·0	3,000	6,600	8·5	.....	47,500
4·1	3,430	6,910	8·6	.....	49,000
4·2	3,860	7,220	8·7	.....	50,500
4·3	4,290	7,530	8·8	.....	52,000
4·4	4,720	7,840	8·9	.....	54,500
4·5	5,150	8,150	9·0	.....	55,000

APPENDIX A.E. V.

Table of differences—Cauvery Dam gauges above 7·0′ in m.c. feet.

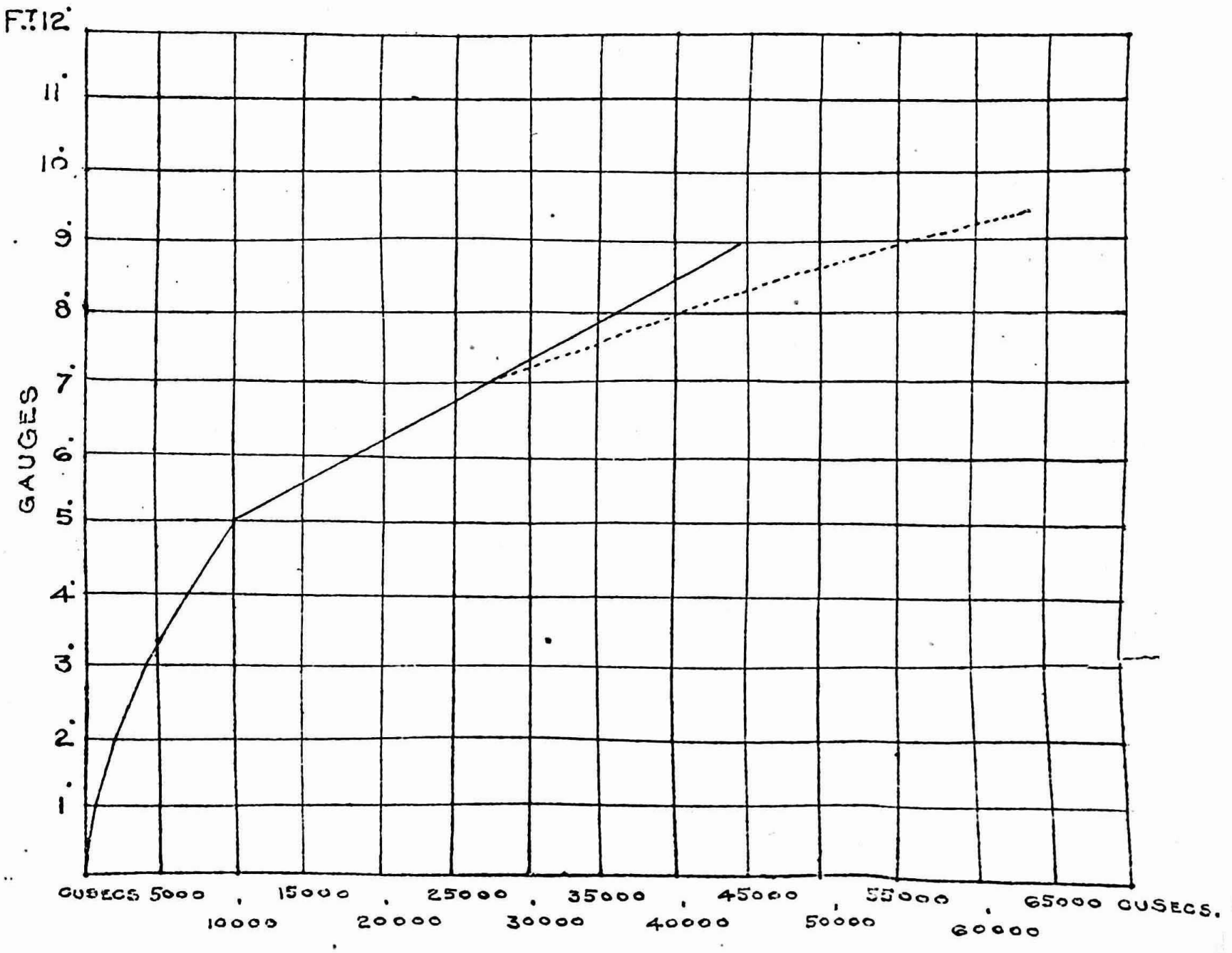
Cauvery Dam north gauge	Difference	Cauvery Dam north gauge	Difference
7·0	...		
7·1	45	10·6	1,780
7·2	90	10·7	1,835
7·3	135	10·8	1,890
7·4	180	10·9	1,945
7·5	225	11·0	2,000
7·6	270	11·1	2,060
7·7	315	11·2	2,120
7·8	355	11·3	2,180
7·9	400	11·4	2,240
8·0	450	11·5	2,300
8·1	500	11·6	2,360
8·2	550	11·7	2,420
8·3	600	11·8	2,480
8·4	650	11·9	2,540
8·5	700	12·0	2,600
8·6	750	12·1	2,665
8·7	800	12·2	2,730
8·8	850	12·3	2,795
8·9	900	12·4	2,860
9·0	950	12·5	2,925
9·1	1,000	12·6	2,990
9·2	1,050	12·7	3,055
9·3	1,100	12·8	3,120
9·4	1,150	12·9	3,185
9·5	1,200	13·0	3,250
9·6	1,250	13·1	3,325
9·7	1,300	13·2	3,400
9·8	1,350	13·3	3,475
9·9	1,400	13·4	3,550
10·0	1,450	13·5	3,625
10·1	1,505	13·6	3,700
10·2	1,560	13·7	3,775
10·3	1,615	13·8	3,850
10·4	1,670	13·9	3,925
10·5	1,725	14·0	4,000

APPENDIX A.E.III

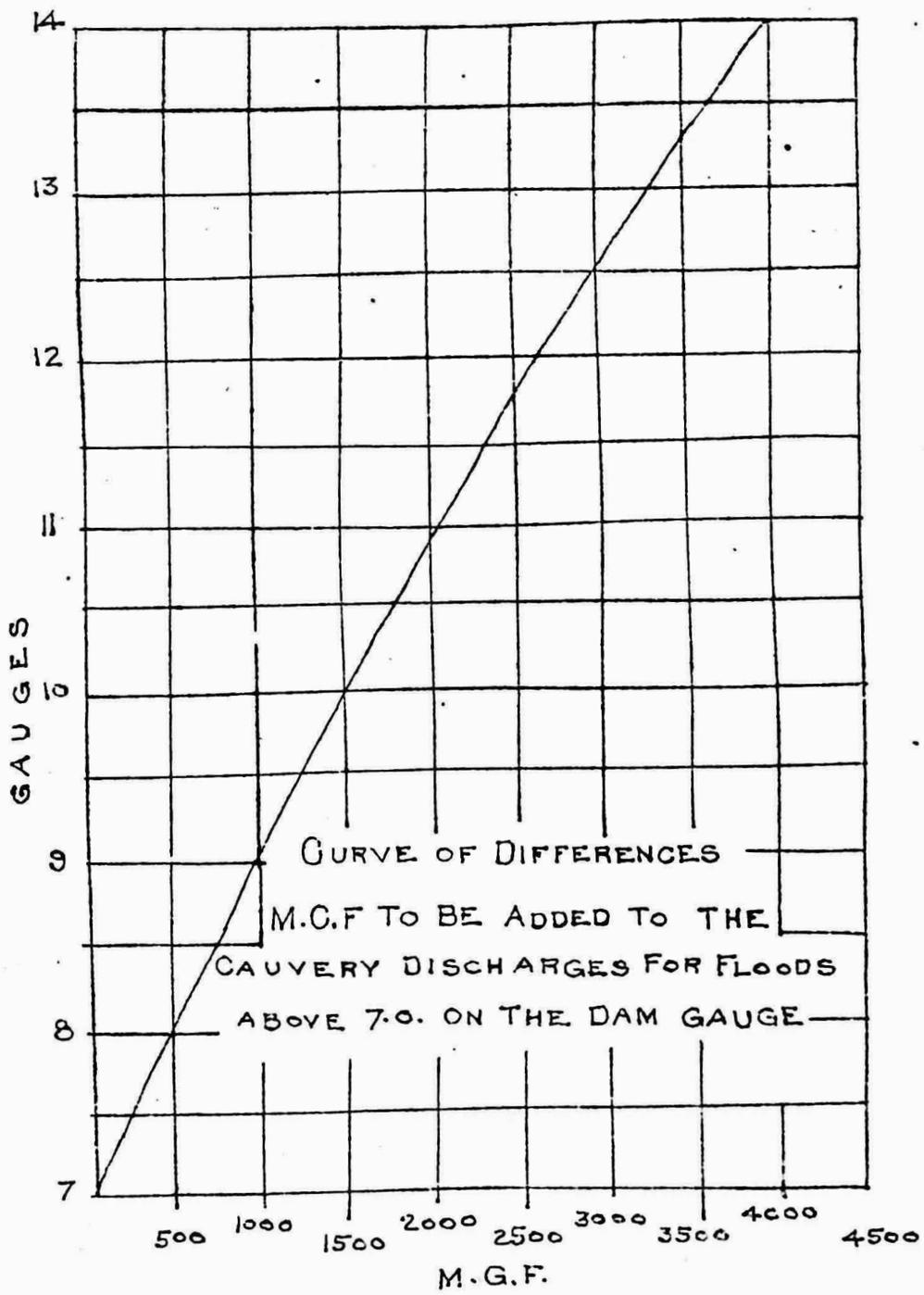
DIAGRAM SHEWING THE MADRAS CAUVERY PROJECT CURVE FOR DISCHARGES OVER CAUVERY DAM COMPARED WITH WHAT APPEARS TO BE A MORE PROBABLE APPROXIMATION FOR GAUGES ABOVE 7·0

MADRAS CURVE SHEWN IN FIRM LINE.

PROBABLY MORE CORRECT CURVE IN DOTTED LINE.



APPENDIX A.E.IV



APPENDIX A.E. VI.

Statement of annual surplus yield for catchment as corrected by Assessor after deducting supplies stated to be used by Madras.

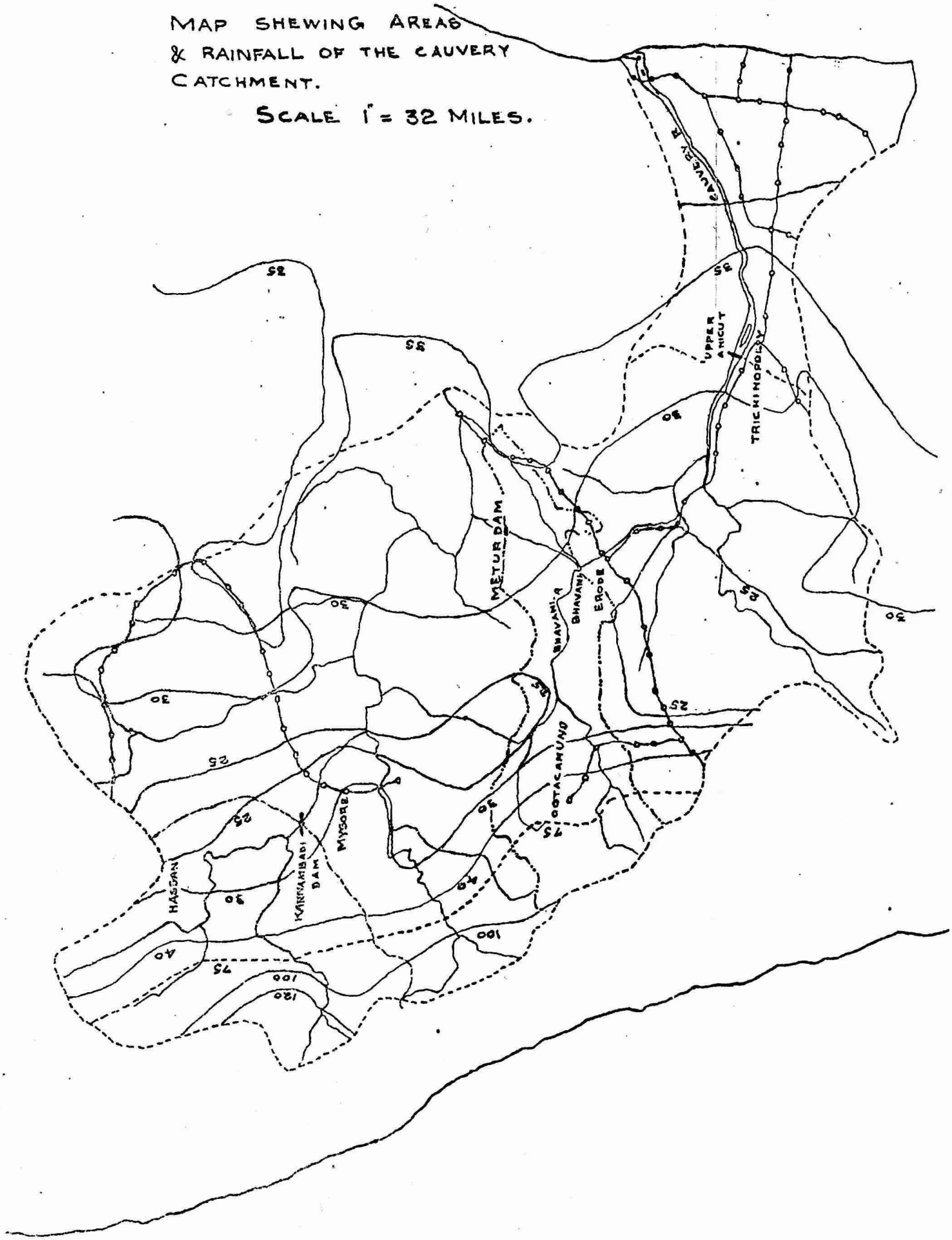
Year	Column 4 of Appendix VI of Ma. 8-a.	Added	Amended total	Irrigation supply, column 4 of Appendix VI, Ma. 8-a.	Amended quantities surplused
1890—1891	288,196	14,105	292,301	204,209	88,092
1891—1892	335,899	16,275	352,174	234,892	117,282
1892—1893	382,685	19,590	402,275	246,637	155,638
1893—1894	395,752	10,715	406,467	309,513	96,944
1894—1895	255,384	6,310	261,694	207,779	53,915
1895—1896	389,099	17,670	406,769	273,365	133,404
1896—1897	682,873	66,955	749,828	310,678	438,150
1897—1898	630,042	57,230	687,272	299,394	387,878
1898—1899	461,362	21,640	483,002	315,730	167,272
1899—1900	203,744	6,780	210,524	157,199	53,335
1900—1901	649,763	66,135	715,898	270,580	445,318
1901—1902	450,804	20,600	471,404	303,263	167,141
1902—1903	412,532	19,270	431,802	263,964	167,938
1903—1904	700,564	44,420	744,984	349,395	395,589
1904—1905	329,269	19,140	358,409	216,300	142,109
1905—1906	241,344	6,135	247,489	176,636	70,853
1906—1907	376,091	13,630	389,721	223,131	166,590
1907—1908	439,258	31,035	470,293	241,750	228,543
1908—1909	320,375	14,920	335,295	194,762	140,533
1909—1910	566,016	20,630	586,656	272,464	314,192
Total period 20 years ...	8,510,052	493,195	9,004,247	5,072,641	3,920,716
Annual averages ...	425,502	24,659	450,212	253,632	196,035

NOTE.—Years in antics are taken as the worst years in Madras evidence.

APPENDIX

MAP SHEWING AREAS & RAINFALL OF THE CAUVERY CATCHMENT.

SCALE 1" = 32 MILES.



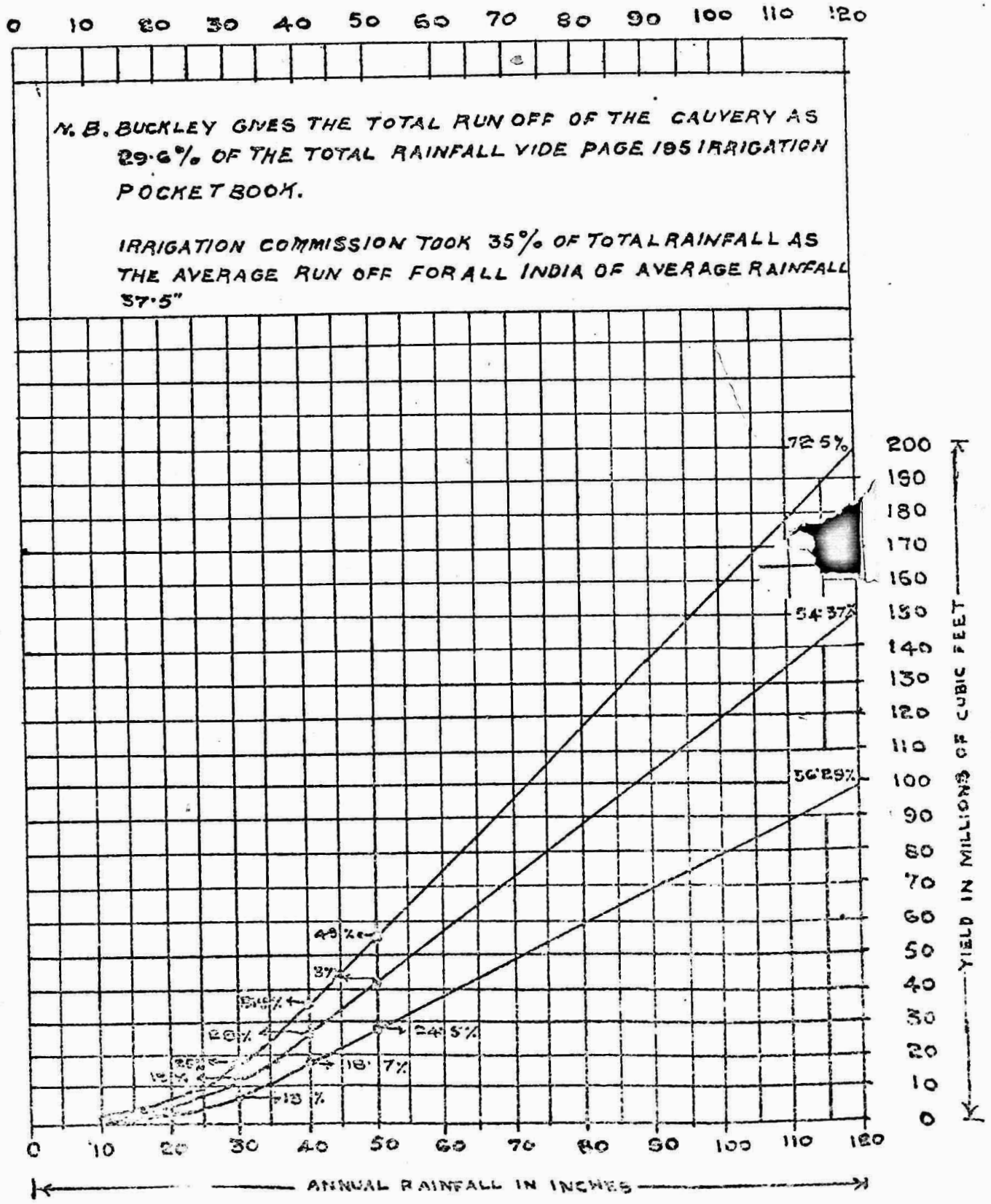
APPENDIX A.E.VIII.

DIAGRAM SHOWING THE RUN OFF IN MILLION CUBIC FEET PER Sq MILE

FOR

VARIOUS ANNUAL AVERAGE RAINFALL FOR GOOD, AVERAGE AND INDIFFERENT CATCHMENTS

COMPILED & EXTRACTED FROM STRANGE'S INDIAN STORAGE RESERVOIRS APPENDIX 2.


0 10 20 30 40 50 60 70 80 90 100 110 120
N. B. BUCKLEY GIVES THE TOTAL RUN OFF OF THE CAUVERY AS 29·6% OF THE TOTAL RAINFALL VIDE PAGE 195 IRRIGATION POCKET BOOK.
IRRIGATION COMMISSION TOOK 35% OF TOTAL RAINFALL AS THE AVERAGE RUN OFF FOR ALL INDIA OF AVERAGE RAINFALL 37·5"
72·5%
54·37%
50·29%
48%
37%
24·5%
18·7%
13%
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
YIELD IN MILLIONS OF CUBIC FEET
0 10 20 30 40 50 60 70 80 90 100 110 120
ANNUAL RAINFALL IN INCHES

APPENDIX A.E. IX.

Assessor's computation of yield based on A.E. VII and VIII.

Rainfall in inches	Total fall per square mile in millions cubic feet	Class of catchment assumed good (*g*) average (*a*) bad (*b*)	Percentage assumed for run-off including losses	Run-off in millions cubic feet per square mile	Upper Anicut		Bhavani		Metur		Kannambadi	
					Area in square miles	Yield in millions cubic feet	Area in square miles	Yield in millions cubic feet	Area in square miles	Yield in millions cubic feet	Area in square miles	Yield in millions cubic feet
			Per cent									
120	276	(*g*)	54	150	404	60,600	404	60,600	404	60,600	404	60,600
110	253	(*g*)	53	135	988	133,380	988	133,380	952	128,520	410	73,800
87·5	201	(*a*)	40	80	2,084	166,720	2,002	160,160	1,311	104,880	840	67,200
57·5	128	(*a*)	37	47	1,498	70,406	1,303	51,241	947	44,509	645	30,315
37·5	98	(*b*)	15	15	952	14,280	696	11,464	594	8,910	.....	.....
35	80	(*b*)	13	11	2,798	30,778	1,656	19,358	2,196	24,156	1,362	14,982
32·5	75	(*b*)	13	10	5,934	59,340	2,166	31,080	4,260	42,600	.....	.....
27·5	62	(*b*)	12	7·5	10,849	81,367	10,716	80,372	5,990	44,925	722	5,415
25	57	(*b*)	8	4·5	3,978	17,891	1,623	7,294	1,536	6,912	256	1,167
Totals ...					29,485	624,762	21,554	554,949	18,190	466,012	4,639	253,469
Average yield per square mile of catchment ...					21 millions cubic feet		25 millions cubic feet		25 millions cubic feet		55 millions cubic feet	
Percentage of total run-off ...					100 per cent		88 per cent		74 per cent		40 per cent	
Proportion between points ...					12 ,,		14 ,,		31 ,,		40 ,,	

APPENDIX A.E. IX (*a*).

Assessor's computation of yield amended to eliminate possible error in map.

Rainfall in inches	Total fall per square mile in millions cubic feet	Class of catchment assumed good (*g*), average (*a*) bad (*b*)	Percentage assumed for run-off including losses	Run-off in millions cubic feet per square mile.	Upper Anicut		Bhavani		Metur		Kannambadi	
					Area in square miles	Yield in millions cubic feet	Area in square miles	Yield in millions cubic feet	Area in square miles	Yield in millions cubic feet	Area in square miles	Yield in millions cubic feet
			Per cent									
120	276	(*g*)	54	150	359	53,850	359	53,850	359	53,850	359	53,850
110	253	(*g*)	53	135	877	118,395	877	118,395	845	114,075	364	49,140
87·5	201	(*a*)	40	80	1,851	148,080	1,778	142,240	1,164	93,120	746	59,680
57·5	128	(*a*)	37	47	1,330	62,510	1,123	52,781	841	39,527	573	26,931
37·5	98	(*b*)	15	15	845	12,675	618	9,270	527	7,905	.....	.....
35	80	(*b*)	13	11	2,485	27,335	1,470	16,170	1,950	21,450	1,210	13,310*
32·5	75	(*b*)	13	10	5,236	52,360	1,923	19,230	3,783	37,820	.....	.....
27·5	62	(*b*)	12	7·5	9,635	72,262	9,517	71,377	5,319	39,892	641	4,807
25	57	(*b*)	8	4·5	3,533	15,921	1,441	6,481	1,364	6,138	227	1,021
Totals ...					26,151	563,388	19,106	489,797	16,151	413,777	4,120	208,739
Average yield per square mile of catchment ...					21·5 millions cubic feet		25·6 millions cubic feet		25·6 millions cubic feet		56 millions cubic feet	
Percentages of total run-off ...					100		87		73		35	
Proportions between points ...					13		14		38		35	

* Included in both monsoons.

APPENDIX A.E. X.

Assessor's computation of yield A.E. IX—(a) distributed between south-west and north-east monsoons.

	Upper Anicut		Bhavani		Metur		Kannambadi		Remarks
	Area in square miles	Yield in mills. cubic feet	Area in square miles	Yield in mills. cubic feet	Area in square miles	Yield in mills. cubic feet	Area in square miles	Yield in mills. cubic feet	
	7,747	422,845	6,225	392,706	5,686	329,927	3,252	202,911	In paragraph 4, Volume I, Metur Cauvery Reservoir Project report, area south-west monsoon is given as 15,700 and north-east monsoon 10,000.
South-west monsoon—									
Percentages ... ... per cent.	100	100	80	93	73	78	42	48	
Proportion between points ... ,,	20	7	7	15	31	30	42	48	
	19,614	140,543	14,091	97,091	11,676	83,850	2,078	19,138	Including the area on which rainfall is 35 inches for Kannambadi only.
North-east monsoon—									
Percentages ... ... per cent.	100	100	72	69	59	23	10	14	
Proportion between points ... ,,	28	31	13	46	49	9	10	14	

APPENDIX A.E. XI.

Comparison of variations in area irrigated in the Delta for twenty years 1890 *to* 1909.

Year	Area taken from diagram Ma. 9	Average	Percentage	
			Plus	Minus
1890	1,018,000		1·8	.....
1891	1,013,000		1·3	.....
1892	1,020,000		2·0	.....
1893	993,000		.....	·70
1894	992,500		.....	·75
1895	993,000		.....	·70
1896	990,000		.....	1·00
1897	996,000		.....	·40
1898	991,000		.....	·90
1899	964,000	1,000,000	.....	3·60
1900	1,001,000		0·01	.....
1901	1,001,000		0·01	.....
1902	996,000		.....	·40
1903	993,000		.....	·70
1904	1,000,000		.....	.....
1905	1,005,000		·50	.....
1906	1,001,000		·01	.....
1907	1,010,000		1·00	.....
1908	1,011,000		1·10	.....
1909	1,013,000		1·30	.....

APPENDIX A.E. XII.

Comparison of variations in supplies for the same years based on the assumed 7·0′ limit as the Cauvery Dam (1890 to 1909).

Year	Water used	Average	Percentage	
			Plus	Minus
1890	201,209	253,632	...	19·48
1891	234,892		...	7·40
1892	246,637		...	2·76
1893	309,513		22·03	...
1894	207,779		...	18·08
1895	273,365		7·78	...
1896	310,678		22·48	...
1897	299,391		18·08	...
1898	315,730		24·48	...
1899	157,199		...	38·02
1900	270,580		6·68	..
1901	303,263		19·76	...
1902	263,964		4·07	..
1903	349,395		37·76	...
1904	216,300		...	14·72
1905	176,636		...	30·36
1906	223,131		...	12·02
1907	241,750		...	4·68
1908	194,762		...	23·21
1909	272,464		7·42	...

APPENDIX A.E. XIII.

Comparison of variations in A.E. XI and XII.

Remissions	Year	Water	Area	Remarks
Rs.				
...	1890	—19·48	+1·8	Reduction in supply coincident with increase in area. Note record area with 20 per cent below normal supply in 1890.
...	1891	—7·40	+1·3	
...	1892	—2·76	+2·0	
...	1893	+22·03	—0·7	Increase in supply not reflected in area.
...	1894	—18·08	—0·75	Decrease in area very small compared to supply.
...	1895	+7·78	—0·70	Considerable increase in supply has not led to increase in area.
11,837	1896	+22·48	—1·0	
...	1897	+18·08	—0·4	
...	1898	+24·48	—0·9	
6,27,295	*1899*	—38·02	—3·60	Considerable decrease in supply comparatively small decrease in area.
14,823	1900	+6·68	+0·01	Increase in area very small as compared with increase in supply.
8,075	1901	+19·76	+0·01	
...	1902	+4·07	—0·4	Increased supply and reduced area.
...	1903	+37·76	—0·7	Considerable increase in supply and reduced area.
67,057	*1904*	—14·72	...	Average area with 15 per cent reduced supply.
15,857	*1905*	—30·36	+0·5	Decrease in supply coincident with increase in area. The decrease in supply was very considerable in 1905 and 1908.
44,969	1906	—12·02	+0·01	
6,571	1907	—4·68	+1·0	
35,208	*1908*	—23·21	+1·1	
26,470	1909	+7·42	+1·3	Same area as in 1891 when decrease 7·40 per cent in supply was equal to 7·42 per cent increased supply in this year.

Years in italics are quoted as bad years in Madras evidence.

APPENDIX A.E. XIV.

Statement showing number of days various gauges were reached in typical years.

Month	5·0′	5·5′	6·0′	6·5′	7·0′	Month	5·0′	5·5′	6·0′	6·5′	7·0′
1890						**1904**					
June	3	...	...	...	...	June	23	19	15	10	6
July	17	14	9	9	8	July	31	31	31	30	27
August	31	25	15	9	7	August	24	20	16	14	12
September	3	1	...	...	...	September	8	5	2	1	...
October	10	8	3	3	3	October	9	5	1	...	...
November	17	14	12	10	9	November	...	...	...	...	...
December	...	...	...	...	...	December	...	...	...	...	...
Total ...	81	63	39	31	27	Total ...	96	80	65	54	45
1896						**1905**					
June	9	9	9	9	9	June	2	2	1	1	...
July	31	31	29	26	23	July	23	21	20	17	16
August	31	31	31	27	23	August	17	11	7	5	4
September	29	22	12	5	...	September	14	11	7	2	...
October	15	9	8	5	5	October	14	8	6	2	1
November	14	8	3	...	...	November	...	...	...	...	...
December	12	7	6	2	1	December	...	...	...	...	...
Total ...	143	118	99	74	61	Total ...	70	53	41	27	21
1899						**1908**					
June	8	7	6	5	5	June	...	...	...	...	...
July	20	17	15	11	8	July	26	24	22	20	17
August	4	4	1	...	...	August	30	28	22	18	17
September	21	16	12	8	4	September	7	5	2	1	...
October	...	...	...	...	...	October	6	5	1	1	1
November	Nil	Nil	...	...	...	November	1	...	...	...	...
December	...	...	...	...	...	December	...	...	...	...	...
Total ...	53	44	34	24	17	Total ...	70	62	47	40	35

Comparison of results.

Year	Number of days	Area per cent.
1890	27	+ 1·8
1896	61	— 1·0
1899	17	— 3·8
1904	45	Normal
1905	21	+ 0·5
1908	35	+ 1·3

APPENDIX A.E. XV.

Statement comparing the monthly average actual irrigation supplies with limit gauge 7'0' of typical years with Madras stated requirements in nearest 1,000 millions cubic feet; differences shown in percentages plus *or* minus *of normal requirements.*

Month	Stated normal requirements	1890	Per cent, *plus* or *minus*	1896	Per cent, *plus* or *minus*	1899	Per cent, *plus* or *minus*	1901	Per cent, *plus* or *minus*	1905	Per cent, *plus* or *minus*	1908	Per cent, *plus* or *minus*
	M.C.FT.												
June	11,000	15,000	3·6	28,000	151	25,000	127	44,000	300	13,000	11·0	37,000	236
July	52,000	40,000	—23	66,000	27·0	46,000	—11	71,000	36	53,000	2	58,000	11
August	47,000	52,000	10·6	70,000	49·0	18,000	—61·7	52,000	9·6	38,000	—19	62,000	32
Total, July and August ...	99,000	92,000	— 7	136,000	37·0	64,000	—35	123,000	24	91,000	— 6	120,000	21
September	33,000	20,000	—40	45,000	36	40,000	21·2	21,000	—36·3	30,000	— 9·1	22,000	—33
October	25,000	26,000	4	37,000	48	8,000	—66	21,000	—16	27,000	8	19,000	—24
November	15,000	40,000	160·0	24,000	60·0	7,000	—53	6,000	—60·0	10,000	—33	10,000	—33
December	8,000	10,000	25	31,000	287·0	1,400	—82	600	—92·0	6,000	—25	3,000	—62·5
Total for six months ...	191,000	203,000	6	301,000	57·0	145,400	—24	215,600	12·5	177,000	— 7·3	211,000	10·5
		Area 1·8 per cent above average supply		Area —1 per cent below average		Area - 3·6 per cent below average. Remission Rs. 6,27,295		Area average. Remission Rs. 67,057		Area +0·5 per cent above average. Remission Rs. 15,897		Area +1·1 per cent above average. Remission Rs. 35,208	

APPENDIX A.E. XVI.

Statement comparing the monthly average supplies with limit gauge 6·2' throughout the years with the stated requirements in nearest 1,000 millions cubic feet; differences shown as percentages plus *or* minus *of the normal requirements.*

Month	Stated normal requirements	1890	Percentage difference	1896	Percentage difference	1899	Percentage difference	1904	Percentage difference	1905	Percentage difference	1908	Percentage difference
	M.C.FT.												
June	11,000	15,000	3·6	24,000	127	23,000	110	41,000	272	13,000	11	37,000	236
July	52,000	37,000	—29	58,000	11	42,000	—19	54,000	3·8	44,000	—15	48,000	— 7·5
August	47,000	49,000	4·2	60,000	28	18,000	—61·7	45,000	— 4	35,000	—25	51,000	8
Total, July and August ...	99,000	86,000	—13	118,000	20	60,000	—10	99,000	.....	79,000	—20	99,000	.....
September	33,000	20,000	—10	43,000	30	38,000	15	20,000	—10	30,000	— 9	22,000	—33
October	25,000	25,000	.....	35,000	40	8,000	—66	21,000	—12·5	27,000	—13	19,000	—20
November	15,000	37,000	146	21,000	60	7,000	—53	6,000	—60	10,000	—33	10,000	—33
December	8,000	10,000	25	31,000	287	1,400	—82	600	—92·0	6,000	—25	3,000	—62·5
Total for seven months ...	191,000	193,000	1·0	275,000	44	137,400	—28	187,600	— 2	165,000	—13·5	190,000	— 0·5
		Area 1·8 per cent above average supply		Area 1 per cent below average		Area —3·6 per cent below average. Remission Rs. 6,27,295		Area average. Remission Rs. 67,057		Area +0·5 per cent above average. Remission Rs. 15,897		Area +1·1 per cent above average. Remission Rs. 35,208	

Arbitrator's Award on Term of Reference 2 (b).

"2. (*b*) What volume of water measured at the Upper Anicut is necessary to conserve these rights unimpaired?"

In the Assessor's Examination of the Evidence will be found a description of the course of the Cauvery. The map A.E. (1) shows the position of the Kannambadi Reservoir and of the various important works on the river.

The claims originally put forward by Madras are set out in the introduction, page 4.

They have been modified subsequently to some extent—see Madras Exhibit 23, and may now be stated as follows—(see Madras Exhibit 3, Part II):—

"The proposals put forward by Madras are that the regulation of water in the working of the Mysore Reservoir must be such as to give to Madras yearly throughout the period June to February (inclusive) the whole flow of the river up to the quantities specified below—

"(i) A discharge in the Aganda Cauvery at the Upper Anicut sufficient to secure a flow over the Cauvery Dam of a depth of seven feet under the conditions existing prior to the remodelling of the Upper Anicut between 1899 and 1902.

"(NOTE.—Such discharge under normal conditions is computed as equivalent to 2,944 million cubic feet in 24 hours, made up of 2,300 million cubic feet passing over the Cauvery Dam and 644 million cubic feet passing over the old Upper Anicut under the conditions of that work before remodelling.)

"(iv) During the period March to May inclusive a supply of not less than 900 cusecs passed without interruption through the left branch of the river at Sivasamudram."

In Ma. 4 (part II, clause 3) an alternative claim to (iv) above is set out as follows :—

"If Mysore deny the right of Madras to the flow of 900 cusecs throughout the months of March, April and May, the Government of Madras claim in alternative throughout this period the whole natural flow of the river up to the limit stated in II (i) Madras reply" which is set out above.

Mysore in their summary of their case on the first and second terms of reference define their position with reference to the Madras claims as follows (see My. 16, paragraph 13) :—

"13. With regard to the flow from June to January the Mysore contentions are :—

(*a*) Right of Madras to six feet flow on the Cauvery Dam for irrigation in the height of the flood season is admitted by Mysore. But it is contended that the alleged claim to seven feet, *i.e.*, one foot extra at the Cauvery Dam, has not been legally acquired as a prescriptive right for want of 20 years' enjoyment (Section 26 of the Limitation Act and Rule III of the Agreement).

(*b*) The alleged claim to one foot on the Upper Anicut, even if it had amounted to an easement or prescriptive right, is not actually existing within the meaning of rule III of the Agreement, as, like an easement of necessity, it ceased when the necessity therefor came to an end by the remodelling of the Upper Anicut in 1899-1902. This flow was not connected with the delta irrigation and cannot therefore be claimed as a prescriptive right for such irrigation as it would impose a new burden on Mysore. The fair inference to be drawn from the alterations to the Upper Anicut made in 1899-1902 and the local circumstances connected with them is that this right, if any, was abandoned by Madras.

(*c*) The Madras claim to seven feet on the Cauvery Dam and one foot over the Upper Anicut is not a single indivisible claim, as, before the remodelling of the anicut, the arrangements in existence were such as would necessarily divide the flow into two parts.

After the remodelling, the one foot flow over the Upper Anicut was altogether detached from the seven feet flow over the Cauvery Dam and completely stopped in actual use.

(*d*) Madras have not earned a prescriptive right to any *one particular limit of flow throughout the period*, but only to fluctuating quantities dependent upon varying flow in the river and the varying needs of irrigation. Mysore also contend that, in determining the extent of the Madras rights, the area under irrigation should be taken to be the chief criterion. The authorities quoted by Madras do not disprove this proposition."

With reference to the hot weather supply (meaning thereby the flow between February and May) the Mysore case is stated in paragraph 12 of their summary (Exhibit My. 16) as follows:—

"12. The first claim relates to the hot weather supply with reference to which it has been pointed out that no understanding has been arrived at as incorrectly assumed in paragraph 99, Madras Part VI, and that this question has also to be decided on the basis of prescription. The Madras case with regard to the hot weather supply has undergone various changes, as noted in paragraph 12 of My. 12. Mysore contend that Madras should adduce satisfactory proof of the circumstances urged by them as supporting their claim to the hot weather flow, the points for decision being as follows:—

(1) whether hot weather irrigation actually exists in Madras above the Upper Anicut under the Cauvery;

(2) assuming the existence of irrigation, whether the right to draw off the water has matured into a prescriptive right in their favour; and

(3) what the extent of such right as well as the limits of flow required are."

Before considering the evidence on the questions at issue, I may here remark that Sir John Benton's note throws no light on the term of reference now under consideration. He made no enquiry into the extent of the Madras prescriptive rights; he has assumed for purposes of calculation a seven feet limit at the Cauvery Dam and it has now been ascertained that some of the figures on which he based his conclusions are erroneous.

Dealing first with the question of the limit gauge on the Cauvery Dam, it has now to be considered whether Madras have made out their claim to a seven foot gauge reading as defined above or whether the contention of Mysore that a six foot gauge reading is sufficient for Madras requirements should be upheld.

The opinion of the Assessor is briefly that neither party has succeeded in establishing the proposition it set out to prove —*vide* paragraphs 19, 83 and 160 of the Assessor's Examination of the Evidence.

The Assessor has made an exhaustive review of the evidence. I do not propose going over the same ground again, and it is not within my province to deal with purely technical matters.

The statistics on the record show that the average acreage under irrigation from the Cauvery reached its highest level during the period 1882-1892. Madras are entitled to expect in the future a supply equal in quantity to that which they enjoyed during that period, and of which they made beneficial use. We have before us various estimates of the quantity actually used based on the application of the limit gauges claimed by either party. Madras contend that, looking to the rules for regulating the supply at the Cauvery Dam and Upper Anicut, and more particularly to the mode and extent of user as displayed by gauge readings, the object and intention of the Engineers in charge of the Delta irrigation in the past have been to maintain whenever possible a gauge reading of seven feet at the Cauvery Dam. The rules in force from time to time are to be found in Appendix I of the Madras case. Rule I of No. IX is as follows:—

"A full and ample supply to the delta is considered to be passing when there is a discharge of 11,240 cubic feet per second into the Cauvery and 6,104 cubic feet per second into the Vennar."

What is described here as a full and ample supply falls far short of the present claim of Madras, and it is now explained on the part of Madras—*vide* paragraph

37, Ma. 12—that "in the face of the executive orders of regulation it is quite clear that the first rule which is of the nature of an opinion or preamble cannot mean that the quantities stated in it are the maximum useful supply to be passed and the obvious interpretation in view of the very fluctuating character of the river is that the rule expresses views as to the average supply considered sufficient."

This rule cannot be brushed aside as a mere expression of opinion. It is a rule laid down for the guidance of subordinate officials as to what a "full and ample supply" should be, and is entitled to just as much weight as any of the others. The Assessor's examination of this particular point (paragraphs 13 to 27) appears to me to place the matter on its proper footing.

The Assessor has not, I consider, given undue prominence to this rule in his analysis of the evidence. In considering this rule, more particularly in relation to the 1882 rules (which were in force at the time the 1893 rules were framed), he has shown that the object and intention of the Madras Engineers was to maintain when possible a gauge reading higher than six feet at the Cauvery Dam, and has demonstrated to my satisfaction that the Mysore contention that a limit gauge of six feet is sufficient for Madras requirements cannot be sustained.

Turning now to the Madras claim to a seven foot gauge, it appears to me that, if the conditions of supplies for irrigation which prevailed when the 1882 rules were in force could be perpetuated, Madras could have no cause for complaint. I agree with the Assessor that these rules did not prescribe that a seven foot gauge reading was to be obtained when possible, *i.e.*, that a seven foot gauge reading was to be considered normal.

In the third rule reference is made to a seven foot gauge reading but it was only after a period of scarcity, that is, when during the previous week the water level had not exceeded six feet at the Cauvery Dam, that the sluices of both branches were not to be opened until water rises to seven feet on the Cauvery Dam gauge.

Madras cannot claim any prescriptive rights under the other rules which have been framed from 1893 onwards.

The evidence before me shows and the Assessor has also recorded his opinion that as far as can be ascertained there has been no material deterioration in the river channels since 1881. Therefore, Madras cannot claim a higher gauge reading now as equivalent to a lower reading under the 1882 rules.

I must therefore hold in agreement with the Assessor that Madras have failed to establish their claim to a gauge reading of seven feet as necessary for the maintenance of their prescriptive rights.

Mysore in clause (b) of their summary contend that, as the effect of the remodelling of the Upper Anicut was to reduce the quantity of water required for purposes of irrigation, it should be presumed that the right of Madras to the extra quantity of water which, before the remodelling, had passed down to the delta, had ceased to exist as the necessity for the extra flow had also ceased.

I have already held (see *supra*, page 88) that the object which Madras had in view in remodelling the Upper Anicut was quite compatible with the intention to retain any rights already acquired.

The Assessor points out that the object which Madras had in view in remodelling the Upper Anicut was to obtain a more effective control over the river for purposes of scour and of irrigation than had existed previously. Madras contend they are entitled to the benefit of any improvements they have made and of the expenditure they have incurred in making these improvements. *Prima facie* it would appear that they are so entitled; but if it could be shown that the so-called improvements only remedied defects due in themselves to a wasteful system adopted by Madras, that Government could not in equity be held entitled to the benefit of the waste. From the Assessor's Examination of the Evidence (paragraphs 66 to 86) it is clear that the system in force before the remodelling was a wasteful one and that large quantities were passed over the Upper Anicut and down the Coleroon which served no useful purpose. The Assessor has shown that the area under the Lower Coleroon irrigation system has increased if anything since the remodelling. I agree with his final conclusion that the Madras claim on this point is untenable.

We must fall back on the doctrine of reasonable use and the "fair and reasonable" condition in the Agreement for an answer to the contention advanced by Madras. I hold that, whatever improvements may have been effected by the remodelling of the Upper Anicut, Madras are only entitled to that quantity of water of which they have made a reasonable use in the past.

In view of this finding, clause (*c*) of the Mysore summary set out above calls for no further remark.

With reference to the supply necessary for the irrigation above the Upper Anicut, and to the hot weather supply, the Assessor has, in his examination of the evidence, given his reasons in full for the conclusions he has arrived at. With those reasons and conclusions I fully agree.

I find (1) that Madras must be held to have a prescriptive right, for the irrigation above the Upper Anicut, to a supply necessary for all channels hitherto in use, (2) that the hot weather supply should be considered the supply for the period between February to May inclusive and (3) that Mysore shall be bound, subject of course to exemption to liability for interruptions beyond their control, to send down during the hot weather season a continuous supply of 900 cusecs to Madras.

So far we have been dealing with matters more or less subsidiary to the main issue, *viz.*, what volume of water measured at the Upper Anicut is necessary to conserve unimpaired the prescriptive rights of Madras. In my finding on this issue I shall also consider the point raised by Mysore whether a limit gauge should not be fixed, varying from month to month or for shorter periods, or whether one limit gauge should be fixed for the whole period from June to January.

The finding on this issue must largely depend on the accuracy of the figures we have to work on and I might have approached this issue with more confidence had it not been for the fact that the figures and statistics furnished us in the course of these proceedings have been proved, to be erroneous or of doubtful value in many instances.

To reduce the risk of error as much as possible, it is necessary that the question should be considered from every aspect so that the conclusion from any one point of view should serve as a check on the conclusion from another. If the conclusions are more or less in agreement and converge towards a particular finding, there will be a strong presumption that the final finding will be as near an approximation to the truth as the materials before us admit of.

I have held *supra* in agreement with the Assessor that the Madras rules of 1882 aimed at ensuring when possible a gauge reading of over six feet at the Cauvery Dam, and that the Madras contention that the rules were intended to maintain a gauge of seven feet could not be sustained.

Therefore, the gauge reading which according to the Madras Engineers in charge of the delta connoted a full and ample supply was something between six and seven feet.

The Metur Project provided for a steady supply during the months of July and August connoted by a gauge reading of 6·1 feet at the Cauvery Dam. An addition of 30 per cent to that supply is not unreasonable in view of the fact that if the Metur Reservoir is not constructed the supply would be a fluctuating one. With the addition of 30 per cent, the gauge readings at the Cauvery Dam, July and August, would be 6·7.

The seven foot gauge reading now claimed by Madras which is aimed at in the rules framed in 1896 and subsequently, has not so far resulted in any notable increase in the delta irrigation area. That area still falls short of the acreage irrigated during the period preceding 1892 while the 1882 rules were in force.

The Assessor has shown very clearly that there is in fact little or no connection between the limit gauge adopted by Madras and the area actually irrigated.

The present dispute between the two Governments has made the question of the limit gauge an important one.

That gauge reading must connote a full and ample supply for the requirements of Madras irrigation. That standard being fixed, it has still to be decided what

surplus is available after Madras requirements have been met, what proportion of that surplus may reasonably be claimed by Mysore and whether the Mysore project for utilizing the surplus is a feasible one.

It is possible that Madras in claiming a limit gauge of seven feet may have in view their new Metur Project. That project is designed to irrigate an area of about 350,000 acres after making full provision for the delta irrigation. It would therefore appear that in the opinion of the Madras Engineers there is in the river, after meeting all the requirements of the delta irrigation, a surplus sufficient for the irrigation of 350,000 acres. It would follow that the gauge limit of seven feet which Madras now claim is more than is sufficient for a full and ample supply to the existing irrigation.

There are various matters which have been dealt with by the Assessor in his Examination of the Evidence and which I have considered in coming to my conclusions on the award on this issue. Where I have not noticed them specifically, it is to be understood that I am to be considered as agreeing with the Assessor's opinion as recorded in his Examination of the Evidence.

ARBITRATOR'S AWARD ON ISSUE 2 (*b*).

Coming now to the volume of water to which Madras is entitled for the conservance of their prescriptive rights, I am advised by the Assessor that a supply of 22,750 cusecs equivalent to a gauge reading of 6·5 feet at the Cauvery Dam as calculated on the Madras curve of 1909 is a reasonable supply for all the requirements of Madras irrigation.

He has arrived at this figure by calculations along three different lines, all of which result in figures in close approximation to 22,750 cusecs :—(1) on a calculation made on the basis of the 1882 rules, (2) on calculations on the basis of 1893 rules with an addition of 25 per cent, and (3) on a calculation on the basis of the duty and estimate of quantities of water necessary for the Delta and Coleroon irrigation as set out in the Metur Project.

I am satisfied that it is not possible on the materials before us to attain a closer approximation of the quantity due to Madras than that set out above. My finding therefore is in agreement with the Assessor that Madras are entitled to 22,750 cusecs for the requirements of their existing irrigation equivalent to a present gauge reading of 6·5 feet at the Cauvery Dam.

I have considered the reasons for and against fixing a limit gauge varying from month to month or shorter periods and I am of opinion that, while it might be held desirable to fix the one limit gauge for the whole irrigation season from June to January inclusive, as I think there would be then less occasion for possible friction between the Governments concerned, I, at the same time, agree with the Assessor that the option in this matter should be left to the Madras Government.

H. D. GRIFFIN,
Arbitrator.

23*rd February* 1914.

PART III.

Assessor's Examination of the Evidence on Clause 3 (a) of Terms of Reference.

General consideration of surplus available as it affects either party.

The clause under consideration runs as follows :—

"3 (*a*). What principles and rules for regulation of the discharges in connection with the Kannambadi Reservoir can best be formulated which will ensure to Madras full protection of their prescriptive rights."

2. At the meeting of 31st March 1914 it was decided by mutual consent of both parties, that the discussion of the rules should be deferred until the award had been given on the question of principle.

3. Before dealing with the evidence and arguments put in by either party on this issue, I wish first to remark briefly on the broad aspects of the case.

4. Appendix A.E.-XVII shews my own estimates of annual surpluses available after deducting from the amended total river supplies taken from column (4) of A.E.-VI, the irrigation supplies taken from column 2 of Ma. 24-e, which would be secured to Madras under the limit of 22,750 c.f.s. = 6·5 feet whenever it is in the river, awarded under clause 2 (*b*). I have restricted the calculations to the thirteen years, 1896-97 to 1908-09 only, because these are the years to which either party has confined its arguments on the present issue, and also because this period includes the four years which throughout these proceedings have been accepted as the worst.

5. Now, considering these surplus figures as they affect the Madras supplies, it must be remembered that a proportion only of the total Cauvery discharge comes from the Kannambadi catchment, and that the Kannambadi Reservoir can in any case hold back only a proportion of the total surplus: this is an indisputable physical fact. Hence a proportion of the surplus flow must reach the Cauvery Dam from other sources uncontrolled by the Kannambadi Reservoir, and Madras must continue to enjoy this proportion of the surplus also as a physical fact, and not necessarily as a matter of prescriptive rights so far as it affects, or is affected by, this present arbitration. It was this physical fact which I wished to illustrate in paragraphs 96-102 of my Examination of the Evidence, Part II.

6. It follows that, even in the worst years, Madras must continue to get occasional flood increments over and above the limit prescribed under the Award. The proportion which the Kannambadi supply bears to that of the whole river supply of the Aganda Cauvery at the Cauvery Dam as it affects the limit flow is a most important factor which, as all admit, has to be determined by further most careful observations. But the many calculations based on various assumed proportions, made by either party in support of their arguments on the issue now under consideration, serve to shew most conclusively that, whatever proportion is ultimately fixed as the result of further observations, it cannot alter this very important physical fact in anything but degree.

7. In pointing out and illustrating this fact, and its general bearing on the case as it affects Madras, I was purposely very careful to guard against any premature expression of opinion, as to how impounding at Kannambadi, if allowed at all, should be regulated and dealt with in its relation to this surplus, which is in point of fact one of the matters now under consideration. Having given this general explanation, I do not propose to notice specifically the various interpretations of the illustration of this point given in A.E.-II to which either party refer at some length in their arguments.

8. Considering this same fact in connection with the estimate of annual surplus as it is likely to affect Mysore, *primâ facie*, it would appear that the Kannambadi Reservoir would probably not have filled completely in the two worst years out of the 13, *viz.*, 1899-1900 and 1905-06, though there would appear to be but

little doubt as to its filling in the other two years of comparatively low surpluses, *viz.*, 1905-06 and 1908-09, and no doubt whatever as to its filling in the other nine years.

9. With this general review on the broadest possible lines of the matter of available surpluses in the river supplies as it is likely to affect either party, I now proceed to examine the evidence and arguments presented in Ma. 10, 13, 14, 24, 25, 26, and 27 and in My. 8, 9, 12, 21, 22, 23 and 24.

General consideration of the different methods of regulating impounding at Kannambadi advanced by either party.

10. These are defined in Ma. 24, paragraph (3), and may be briefly referred to here as (1) the Madras system, (2) the Mysore system, and (3) the proportionate system, and during the discussion on the evidence, a modification of the Madras system (1) was suggested by Mysore to which I shall also have to refer.

I.—Madras system.

Ma. 10 (6).
Ma. 24 (3) (i).

The Madras proposals were for daily measurements at selected points of actual supplies of the Kannambadi and Kabbini catchments and, after applying a factor to this combined discharge in order to cover possible losses *en route*, to allow impounding at Kannambadi only on days on which the combined Kannambadi and Kabbini supply, less the addition to cover losses of transmission, might be greater than the limit flow required at the Cauvery Dam.

This proposal may be expressed algebraically as

$$I = (1-f)(Kn + Kb) - C \text{.....Equation (1)}$$

where I is the quantity which might be impounded on any day, f the factor applied to cover losses *en route*, Kn and Kb, the Kannambadi and Kabbini measured supplies, and C the limit flow at the Cauvery Dam. Equation (1) might also be written :—

$$I = P(Kn + Kb) - C \text{.....Equation (2)}$$

where P, a proportion factor including losses, replaces $(1-f)$.

11. During the discussion of this proposal at the meeting of the 11th instant, the Madras Representative stated that, whatever value might be found from actual observations to be the true value for P, *i.e.*, whether it was less or greater than unity, or in other words whether the value of f in equation (1) was proved to have a *minus* or *plus* value, their intention was never to increase the value of P in equation (2) above unity. Thus, their intention was to make the combined Kannambadi and Kabbini catchments responsible for the whole limit flow under the Award, ignoring the yield from the Bhavani and other tributaries below Sivasamudram, and giving Mysore no benefit of any actual *minus* value of f in equation (1), even should such a *minus* value be proved to be warranted by actual observations at stages of river flow affecting impounding.

12. Mysore very strongly objected to this proposal, and I need only record here, for consideration of the Arbitrator, my opinion, that while, in making the proposal, the Madras Government doubtless believed it to be necessary for the full safeguarding of their important vested interests in the Cauvery supplies, *primâ facie* it does not appear to be compatible with a fair and reasonable interpretation of the 1892 Agreement. No working tables or statistics based on the proposal have been put in by Madras in its support for the reason given in Ma. 34 (15) that no reliable data are available.

II.—Mysore proposal.

13. The Mysore proposal was to make the daily measured flow of the Kannambadi catchment the criterion of impounding by applying to it a factor to be ultimately fixed by actual observations, and then forecasting the total yield at Cauvery for three or four days later and allowing for impounding at Kannambadi any excess of this estimated flow at the Cauvery Dam over and above the limit flow under the Award. They also proposed to make good from their reservoir any proved deficits in the actual flow as measured at the Cauvery Dam three or four

days later such as might occur owing to any error in the calculations or variation in the proportion. Put into algebraic form the proposal may be stated as follows :—

$I=(P\ Kn-C)\times\frac{100}{100-t}$ or $(P\ Kn-C)\times\frac{100+t}{100}$ according as the transmission loss is reckoned on the Kannambadi or Cauvery flow, where, as before, I = the quantity it is permitted to impound on any given day, P is the factor which the Cauvery discharge bears to the observed discharge of the Kannambadi and C the limit flow at Cauvery Dam under the award, and the transmission loss reckoned either on the Kannambadi or Cauvery flow.

14. Apart from the provision for compensation water to be given when found to be due, the essential difference between this proposal and that of Madras is that it would make the whole catchment above the Cauvery Dam jointly responsible for the limit flow under the Award instead of only the Kabbini and Kannambadi catchments as in the Madras proposal, and would allow Mysore the benefit of the actual value of P as determined by actual observations instead of arbitrarily restricting it to unity irrespective of its actual value as in the Madras proposal.

15. The Mysore proposal, as a whole, while frankly designed to admit of the maximum possible storage of surplus water available at Kannambadi after the Madras limit supply was ensured, also provided for making good from the stored water any deficiencies in the limit supply which might occasionally occur owing to error of calculations. As to the proposal generally, I need only record my opinion for consideration of the Arbitrator that *prima facie* there is nothing in it which is incompatible with a fair and reasonable interpretation of the 1892 Agreement. I shall deal with the Madras objections to it later.

III.—Proportionate system.

16. The third or proportionate system as it has come to be called is that which was tentatively used for the purpose of my Examination of the Evidence, Part II, the true import of which I have already explained in paragraphs 5 to 8.

This proposal would also make the Kannambadi discharge the criterion of permissible impounding, the assumption being that when the correct relation between the total natural flow of the Aganda Cauvery at the Cauvery Dam and that at Kannambadi is known for stages of the river flow at the Cauvery Dam from 6·5′ and upwards, impounding can be regulated with due precautions to safeguard Madras against any material loss or deficiency of necessary supply.

17. In essence it differs from the Madras proposal in exactly the same particular as does the Mysore proposal already defined.

In essence it does not differ from the Mysore proposal, though in detail its working would be designed to eliminate any necessity for passing compensation water by ensuring no shortage due to any error in fixing the proportion factor or by providing against variations from it being prejudicial to the Madras rights.

18. Both parties admit that it would be simpler and easier of application than either of the others and it has also the great advantage that it would as far as possible eliminate all elements of future dispute and misunderstanding between the two parties as to the working of the reservoir.

19. From this general explanation of proposals, it will be clear that it will require certain further elaboration with regard to the limits to be fixed for permissible impounding so as to obviate the risk of shortage below the limit flow and the necessity for passing compensation water; but I must defer more detailed consideration of this point until I have completed my examination of the results of the working tables which have been prepared by either party on their interpretation of the third or proportionate method and of the Mysore or second method and the arguments they have based on the results. As already stated, no such tables or results have been put in, in support of the first or Madras method.

IV.—Modification of the Madras system suggested by Mysore.

20. In My. 22, (9)-(17), the Madras system is discussed and the Mysore objections to it are pointed out, the most important of which is the exclusion from the

calculation of the yield from all other catchments except the Kabbini and Kannambadi, but Mysore signify their willingness to accept the Madras system if the proportion factors for the combined Kabbini and Kannambadi supplies of ·75 and ·33 are adopted for the two monsoons instead of the Madras proportion factors of 1·25 and 1·00.

21. In this connection it is relevant to note that in Ma. 10 (33) Madras claims that the amount of water issued by Mysore at her reservoir must be such as will not involve Madras in any risk of receiving at the Upper Anicut water less than that which constitutes the natural flow, unless this exceeds the quantity to which a prescriptive right has been established, and in Madras 10 (32) the admission is made that the Bhavani "can be counted on to pass material contributions throughout most of the irrigation season to supplement the flow of the main river." While the reference to its flow at certain seasons being insufficient to supply the draw-off of the Cauvery channels above the Upper Anicut obviously applies to low stages of flow in the river which can hardly affect the question of contribution at the stage of limit flow.

22. Thus, but for the restrictions put by Madras on the factor, as already described in paragraph (11), it is possible that the two parties might have come to some mutual agreement as to working under this system as modified by Mysore.

23. It is, however, submitted for consideration of the Arbitrator that it would involve measurments at two places instead of only at one, as does the third system; while the complete check on those measurments, which in the third system will be afforded by the reservoir gauges, makes it in my opinion far preferable to any system of measurement at two places.

24. Madras have signified their consent to the third system in the event of their own proposals not being accepted and subject to certain safeguards which they consider necessary to apply to it. But it is to be noted that this qualified consent can only apply to their own application of it, to which application Mysore has never given even a qualified consent urging the fairness of their own system also with due safeguards, though they signified their consent to raising the proportion limits of their own proposed system to ·625 and ·3 without compensation water in lieu of lower limits connected with compensation water.

Ma. 24 (4), (9) and (13).
Ma. 25 (20).

My. 22 (36).
My. 22 (34) and (35).

24.-A. But although the two parties differ about the methods of working best suited to safeguard or promote their own interests, it is very satisfactory to point out that there is no difference between them on the essential principle to be observed; Madras contending [Ma. 14 (112)] that the matter should be decided "strictly on the basis of the Agreement of 1892 and the preservation of the existing rights of Madras unimpaired"; while Mysore [My. 8 (103)] claim that they shall be given the maximum facility as far as practicable for impounding only so far as is consistent with non-interference with Madras prescriptive rights in any way.

General review of evidence put in by either party.

25. All the statements and abstracts which have been prepared by either party for the purpose of examining the probable working of the Kannambadi Reservoir, if it is allowed, and for making their recommendations as to the principles which they consider should be adopted for the purpose of protecting Madras rights on the one hand, and, on the other hand, of allowing Mysore the maximum facility for storage consistent with the protection of Madras rights, are, in absence of complete reliable data, based at present on various arbitrary assumptions as to the ratio the natural yield of the Kannambadi bears to the natural Cauvery yield and as to the percentage of losses in transmission. As to this, as already noted, all concerned are in complete accord that any assumptions made for the present purpose of this examination of the case can only be accepted tentatively and that, if the reservoir is ever constructed, they must be replaced in due course by proportions to be fixed by actual observations. I shall deal with this important matter later.

26. Further, the working tables from which the various abstracts and statements have been compiled are themselves based on other assumptions and calculations of discharge of the Kannambadi catchment, from records of gaugings at

various sites in the catchment where these are available, supplemented, where they are not available, by theoretical calculations of run-off based on records of rainfall. For a tentative assumption as to the percentage to be allowed for losses in transmission, 40 per cent for June and 22·5 per cent for the remainder of the year was decided on after discussion—*vide* Proceedings of the 26th February 1914.

27. While these various assumptions are admittedly arbitrary, they were accepted as the best then available after discussion with both parties and were accepted for the purpose of examining the effect of the Kannambadi Reservoir as it would have been worked under the various assumptions as to factors and methods of working.

28. Each party has checked the various statements and abstracts, put in by the other party, and as was recorded at the meeting before the Assessor on the 1st April 1914, the figures have been accepted by each party as materially representing the facts they are designed to illustrate.

29. The results of the working of the reservoir under the assumptions as to ratios and the two methods considered have been compared with the actual supplies based on the Cauvery Dam, gauging records of which are complete, and are given in Volume III of the Metur Project.

30. Now, of these two sets of river gaugings, those based on the Cauvery Dam gauge records are far more reliable than those calculated, as has been indicated, from the incomplete Kannambadi data; and where any glaring inconsistencies occur in the comparisons which have been made between the two, the former must be considered as much more reliable than the latter.

31. Thus the reference made by Mysore, My. 21 (3), to the Kannambadi discharges having been duly approved by the Assessor, must be understood to be strictly qualified by the explanation I have given regarding that approval in paragraphs 16 to 30.

Consideration of proper standard of material loss to Madras.

32. Before proceeding to examine in detail the arguments of either party on the results they have deduced from the working tables and connected statements, I wish to make quite clear exactly what standards of comparison are logically relevant whereby to test the results as they affect the case in point, namely, the securing of Madras in her prescriptive rights to the limit gauge under the award, and in protecting her against material loss or injury to her irrigation.

33. Firstly, it must be borne in mind that, while the award under clause 2 (*b*) ensures to Madras the right to a flow of 22,750 c.f.s.=6·5 feet on the Cauvery Dam gauge whenever it is in the river, it does not in any sense imply that, in order to fully conserve her irrigation interests, this quantity of water is necessary on every day of the irrigation season from June to January.

34. The actual needs for irrigation vary from month to month, and these monthly measurements have been calculated in the Metur Project both in reference to duty and actual areas, and in reference to the estimated irrigation supplies of the past.

35. If that most careful piece of work is to be taken seriously, it must be accepted that the monthly supplies estimated as necessary for existing irrigation, as given in table on page 18 of Volume I of the Metur Project, afford a most reliable criterion of monthly supplies which are really necessary to conserve the existing irrigation. If, on the other hand, those estimates are not to be taken seriously, it may fairly be asked whether any of the statements of requirements put forward by Madras in this case can be given any greater value.

36. The supplies actually required, as given in the Metur Project, may be compared with those that would be received if the limit flow under the award were available every day in the month as follows:—

July—actually required, 51,149 millions cubic feet.
August—actually required, 47,461 millions cubic feet.

while, if the limit flow of 1,966 millions cubic feet were available every day in the month, the volume received would be 60,946 millions cublic feet or from 19 to 26 per cent in excess of the actual requirements.

37. This comparison brings out clearly that the rules and regulation of the past, which constitute the basis of the prescriptive right of Madras, as well as of the estimate of that right made for the purposes of the award under clause 2 (*b*), prescribed the limit gauges under the rules, not because the irrigation required the quantity of water connoted by the limit gauge on every day of the irrigation season, but because in dealing with a source of supply which was known to be fluctuating it was necessary to fix a limit gauge above normal daily or monthly requirements in order to ensure getting those normal requirements from the fluctuating supply.

38. Hence, when the effect of impounding at Kannambadi comes to be examined in detail, this very important aspect of the limit gauge must be borne in mind.

39. In my general examination of the case, as it affected the award under issue 2 (*b*), for purpose of the comparisons made in A. E.-II., I accepted the standard supplies necessary for irrigation, as given in the table I have referred to.

They are as follows:—

June	10,680	m.c.ft.
July	51,149	„
August	47,461	„
Total, July and August	98,610	added by Assessor.
Average „	49,305	
September	32,791	m.c.ft.
October	25,293	„
November	15,240	„
December	7,965	„
January	3,240	„
Total ...	194,320	„

40. In the note at the bottom of the same table, it is explained that these monthly standard supplies include provision for extension of second crop in the delta amounting in the aggregate to 4,270 millions cubic feet; the figures for each month may therefore be adjusted to existing areas, without the extension, by a reduction of $\frac{4,270}{194,320}=\frac{1}{45}$th. On the other hand, they do not include any provision for 27,000 acres, French irrigation, which would require them to be increased by about 1-38th. The figures should therefore be increased by the fraction $\frac{45-38}{1,710}=\frac{1}{244}$.

41. This correction is more than covered by the following:—

June	10,750	m.c.ft.
July	51,400	„
August	47,650	„
Average, July and August	49,550	„
September...	32,950	„
October	25,400	„
November	15,300	„
December	8,000	„
January	3,250	„

The corresponding average daily discharges and gauges necessary to give them on the Cauvery Dam are as follows:—

	Millions cubic feet	Gauge	
June	358	3·0	feet
July and August	1,600	6·0	„
September	1,098	5·3	„
October	820	4·7	„
November	510	3·8	„
December	260	2·4	„
January	216	2·1	„

and it is these which have to be compared with the limit 1,966 millions cubic feet = 6·5 feet in the award which is designed to give those normal irrigation supplies from a fluctuating river.

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42. While I accepted the figures as they stood for the purpose of my examination of the evidence under clause 2 (*b*), indicating in paragraph 165-A that the omission from them of the specific requirements of French irrigation would not very materially affect them, I consider it desirable for the purpose of the examination, which I now have to make as to the effect on the supplies of the impounding at Kannambadi, to modify them so as to include the specific proportions required for the French irrigation, and therefore the standard which I suggest for the consideration of the Arbitrator as a proper one to use in this connection is that given in paragraph (41).

43. I wish to make it quite clear to all concerned, that nothing I have written in the foregoing discussion as to the essential principles of the award limit as it affects necessary supplies, can be held, or is intended, to impair in the slightest degree the right of Madras to the limit flow under the award whenever it is in the river during the period June to January, and therefore that the primary object to be kept in view in framing principles for the regulation of impounding at Kannambadi Reservoir must be to ensure this right.

44. But when the effect on the Madras supplies of the impounding at Kannambadi under those principles comes to be examined, it is reduction below the standard supplies given in paragraph 41, which I submit for the consideration of the Arbitrator must be held to be the criterion of material loss or injury to Madras existing irrigation, including that in the French territory, under any fair and reasonable interpretation of the 1892 Agreement.

Examination of evidence as to effects of proportionate system as advanced by either party.

45. With this criterion, the effects on Madras of impounding under the proportionate system and under the Mysore system put in by either party and their arguments thereon, may now be examined.

I much regret to find that my request that the figures in column (3) of the abstracts, Ma. 24 (*e*), should be amplified by amended figures calculated for natural flow after impounding, without any limit, and also as subject to the limits of 2,300 millions cubic feet and of 2,944 millions cubic feet, should have been misunderstood by Madras, and that thereby they should have been put to the unnecessary labour of preparing the other abstracts, Ma. 25-A 1-13, which, though they contain the figures I asked for, contain also others which are of no use to me. My object in asking for those amended figures was to ascertain at what stage of flood increments the quantities, shown in Ma. 24 (*e*), column (4), as losses, or as water of which Madras was deprived by impounding under the 1,966 millions cubic feet limit, would disappear or be replenished. I very much regret if this misconception was due to any want of clearness in my request, which was, however, clearly recorded in the proceedings of the 19th March.

46. For example, in Ma. 24 (*e*), during the second-half of June, Madras shows in column (4) that she would have been deprived of 192 millions cubic feet; the quantity she received, reckoned under the 1,966 millions cubic feet limit, and shown in column (3), being 19,106 millions cubic feet.

Now, in Ma. 25-B (*a*), for the same year, the quantity of water actually received by Madras in that half-month would have been, with no limit of assumed useful supply, 30,454 millions cubic feet; with the assumed useful limit of 2,944 millions cubic feet, 24,325 millions cubic feet; and with the assumed useful limit of 2,300 millions cubic feet, 21,105 millions cubic feet.

So that, counting as useful surplus, or useful flood increment, to call it by another name, that actually obtained even only subject to the 2,300 millions cubic feet assumed useful limit, the deficit shown under the assumed 1,966 millions cubic feet limit would have been much more than covered. This is only another demonstration of the effect on monthly supplies of the natural flood surpluses which must be enjoyed by Madras as a physical fact which I dealt with on broad lines in paragraphs 5 to 8.

47. The same point is also brought out by Mysore, and I submit for consideration of the Arbitrator that it must be accepted that the quantities represented by

Madras as losses in column 4, are not real losses if they are covered by quantities shown to have been actually received over and above the assumed 1,966 millions cubic feet limit, as these were. They could only be considered as losses on the assumption that no gauge over 6·5′ on the Cauvery Dam was useful to Madras, an hypothesis which Madras have specifically repudiated in Ma. 24 (20). And further the losses could only be considered as material if they could be shown to have reduced the monthly flow below the standard, which, as I have suggested (paragraph 44), must be taken as the criterion for purposes of this Arbitration.

48. The statement Appendix A.E.-XVIII exhibits the effect of this flood increment, assumed, for the purpose of this examination, as useful only up to the 2,300 millions cubic feet limit for the four worst years; as will be seen, the losses shown as such in Ma. 24 (*e*) would nearly all have been more than covered by the increments actually received above the 1,966 millions cubic feet limit and below the 2,300 millions cubic feet limit, while in most cases where they were not covered the loss was immaterial judged by the criterion suggested in paragraph 41.

49. In only two periods was the material loss not covered, in August (2) 1899, *viz.*, when the half-monthly losses were 273 millions cubic feet, equal to an average supply of 195 cusecs per day for the period: and in August (2) 1905 when the loss was 60 millions cubic feet equal to an average of only 46 cusecs per day for the period. It may be pointed out that these results are based on the lower proportion assumed for impounding and, as pointed out by Madras, would be less for higher assumed proportions.

50. As a matter of evidence it will be seen by reference to column (4) of table X that, under the higher assumed proportion of ·625, the loss in August 1899 would have been reduced to 126 millions cubic feet equal to an average supply of 92 cusecs for the whole period, while the loss in August 1905 would not have occurred at all.

51. Apart from this the result of the comparison afforded by the two sets of tables and abstracts calculated from the proportions of ·60, ·40 and ·65, ·425, as represented by Madras, tends to show that Madras would get rather less water under the former and lower proportions than she would under the latter and higher proportions; and on the strength of this argument and in view of the shortages referred to in paragraph 46, Madras suggests that proportionate factors of not less than ·65 for the south-west monsoon, and ·425 for the north-east monsoon, should be adopted for tentative purposes.

52. The general result of the examination of this aspect of the case as presented by Madras goes to show that under the assumed proportion factors of ·625 and ·425 as worked out in detail by Madras, under the award under clause 2 (*b*), in only one half-month in the four years, her irrigation supplies would have suffered material loss and that to a very slight extent: and that even under the ·6 and ·4 limits the material losses she would have been put to, as regards irrigation supplies, would also have been very small and confined to only two half-monthly periods in the four years examined.

53. Now these four years are admitted as the worst years as regards supply in the period of thirteen years for which tables have been prepared, and it would therefore appear quite safe to infer that material interference in the whole period of thirteen years would have been confined to the same periods and to the same limited extent.

54. Remembering that the working tables contain the inherent defects due to the uncertain factors used in their preparation as defined in paragraphs 26 to 30, I cannot say that these small deficiencies which may possibly be due wholly to those defects in the assumptions can be held to substantially support the Madras claims for a higher tentative factor than those which have been assumed in the tables.

55. The Madras criticism of the Mysore proposals are illustrated by diagrams prepared for the years 1898, 1902, 1904, 1905 and 1908 for varying factors.

In these diagrams Madras exhibits the effect on the Cauvery Dam supplies of the impounding at Kannambadi, based on the same calculated discharges at Kannambadi as are used in the working tables under the proportionate system, and

compared with the Cauvery Dam discharges as based on the gauge records. In this comparison there are three uncertain factors any or all of which may tend to vitiate the results; these are—

(1) the Kannambadi discharges ;

(2) the period of time assumed for transmission of water between Kannambadi and Cauvery Dam ; and

(3) the proportion factor.

56. As in the case of the examination of the proportionate system, the Cauvery Dam records are the most reliable reference we have in the comparison, and any glaring inconsistency brought to light in the comparison should be regarded as directing suspicion to one or other of the three less reliable factors rather than to the more reliable Cauvery Dam gaugings.

57. The Madras objections to this system are defined in Ma. 10 (5) and Ma. 24 (14) and (19). These objections are—

(*a*) that it does not ensure to Madras the quantities of water to which she is entitled ;

(*b*) that it alters in a way unfavourable to irrigation supplies the natural distribution and fluctuation of flow ; and

(*c*) that it is a complicated system likely in practice to prove fruitful of disputes and misunderstandings.

There is a further objection to the Mysore proposals urged by Madras in Ma. 14 (112)-(126), in which they contend that, as this system involves measurements at the Upper Anicut, it would impair Madras existing rights to full control and development of works below the Mysore boundary and above the Upper Anicut, and would impair the existing rights of Madras on all streams below the Mysore boundary which are wholly within Madras territory.

This is in fact the same contention which (*vide* paragraph 10), Madras advanced in her own proposals, as to the principles to be decided in the present issue; it would throw on the Kabbini and Kannambadi the sole burden of the maintenance of the prescriptive rights found due to Madras under award 2 (*b*), and, as recorded in paragraph 12, it appears to me to conflict with any fair and reasonable interpretation of the 1892 Agreement, and I do not propose to examine it further.

58. To examine the contentions as defined in paragraph 57 (*a*) to (*c*), I need refer only to one of the diagrams, my remarks thereon being applicable *mutatis mutandis* to all alike. Take for instance Ma. 24 G-1, the diagram showing incidence of the Kannambadi flow as affected by impounding and comparing it with the Cauvery Dam actual records for the year 1908.

59. Regarding the first contention, it will be seen that the flow at Cauvery Dam resulting from impounding under the Mysore system, fell below the 6·5 limit on four separate occasions, three times in July and once in August. These are hatched red in the diagram. Now, for example, on the 5th July, the Cauvery Dam actual supply was very nearly 8,000 millions cubic feet as shown by the firm line and it is extremely improbable that even holding back the whole supply available at Kannambadi at such a stage of the river flow could have reduced the Cauvery Dam discharge to below 3,000 cusecs, as shown by the dotted line. It would mean that in a river flow at that high stage the Kannambadi catchment was yielding nearly twice as much as the total yield of the whole of the rest of the catchment. None of the examinations of this matter of proportion obtaining between the Kannambadi and Cauvery flow, which are in evidence, support such a supposition in the slightest degree, and there are other similar inconsistencies obvious in the diagram to which I need not refer in detail.

60. Such inconsistencies appear to me to point to the uncertain factor, number (1), as defined in paragraph 54 being incorrect, rather than to incorrectness in any of the others, and it is probable that snch inconsistencies would disappear if this was corrected.

61. Then, again, in regard to the Madras second contention as to interference with the incidence of flow, for example, that which occurs between the 10th and 15th July, is clearly due partly to the fact that in the diagram Madras have repeated the

misconception as to useful increments over the 6·5 limit which I have already discussed in paragraph (46), which misconception as exhibited in the diagram certainly tends to exaggerate the interference; and it may also be partly due to the incorrectness of the second uncertain factor defined in paragraph 54.

61-A. Thus the portions hatched in white which represent increments over and above the 6·5′ limit shown in the diagram as useless, should, in point of fact, be hatched yellow as useful; if this correction were carried out, the comparison between the red and yellow hatching would be more in accordance with the facts; and if further the other correction of the deficiencies shown below the 6·5′ limit discussed in paragraph (58) were also made, the diagram would probably indicate that the Mysore contributions of compensation water from its storage would preponderate over the actual reductions below 6·5′; and the impounding with the provision for compensation water as suggested by Mysore, might then be shown to be a material help to Madras at a period when, under natural flow, she would have received less than the 6·5′ limit, such, for example, as is evidenced in the diagram in the period between the 10th and 15th July.

61-B. This in point of fact is only what would be expected from a reservoir storing water, when, in excess of required flow, and giving out increments when the natural flow was deficient. It is indeed exactly what is proposed to be done in working the Metur Reservoir in the Madras project; and if the Kannambadi Reservoir were in territory directly under the administration of the Government of India there is no doubt but that this system would be adopted. It is the fact that the proposed Kannambadi Reservoir is in Mysore which gives weight to the third Madras contention against the system proposed by Mysore and it is on this account I consider that the third or proportionate system is preferable.

62. The general result of this examination which *mutatis mutandis* is applicable to all the other diagrams is that, remembering the three uncertain and tentatively assumed factors used in preparing the diagrams, the interference with the Cauvery limit flow and irrigation supplies is extraordinarily small; this has been urged by Mysore. Also, that such interference as there is would probably be eliminated by correction of the various assumed factors on actuals being available. But as I agree with Madras on their third contention as stated in paragraph 61, it is perhaps unnecessary that I should consider this matter further.

63. The replies of Mysore to the Madras contentions (1) and (2) as illustrated by the statements My. 24 (*a*), (*b*), (*c*) and (*d*), and their arguments both on the proportionate system, and on the Mysore system, are in general accord with the opinions I have recorded as the result of the foregoing examination in each case, and I need not refer to them in further detail.

Mysore contention that comparatively small losses to Madras and great loss to them entailed in various systems should be considered.

64. There is, however, one other contention of Mysore in respect to both systems which I have not yet noticed, namely, that, as the effect on Madras supplies is shown by the various methods examined to be proportionately so much less than it is on the Mysore storage, this fact should be held to justify either lower proportions being adopted for the proportionate system than those proposed by Madras, or the adoption of the Mysore system.

65. The only reply to this contention which, in my opinion, is in any way consistent with the terms of the 1892 Agreement, and which I submit for consideration of the Arbitrator, is that which is urged by Madras, *viz.*, that the Madras interests are existing and prescriptive, while the Mysore interests are non-existent and prospective, and that therefore under the Agreement nothing should be awarded in respect of the latter which could in any particular be shown to prejudice the former.

66. I trust the scant direct notice I have, in the foregoing examination, given to the Mysore arguments and statements prepared by them in connection with this issue will not be taken as an indication that I have not examined them or that I have not fully considered them. On the contrary, they have been of very material assistance to me in arriving at the opinions I have formed, and it must be remembered that, as both parties have, in the preparation of the evidence on this

issue, been working on the same lines, examination of one set of evidence entails the simultaneous examination of the other.

With this explanation I need not refer further to the Mysore arguments regarding the principles to be adopted for the award under this issue.

Madras contention that specific share of flood increments is necessary for the Coleroon irrigation.

67. Before I can proceed to formulate my detailed recommendation on the issue for the consideration of the Arbitrator, there are two more very important points which it is necessary that I should discuss.

68. The first is with regard to the many references made by Madras to the necessity over and above the limit flow for flood increments specially for the Coleroon irrigation.

69. From all the evidence in the present case, it appears to me to be quite clear that there must be very considerable supplies to the Coleroon due to leakage through, or under, the Upper and Grand Anciuts or, as suggested by Mysore, from seepage, which supplies are unregistered by the Cauvery Dam gauge and are therefore not included in the estimate of supplies based on the Cauvery Dam and Upper Anicut discharges. I refer particularly to the long periods when the Cauvery Dam gauge is below 5·5′, the point at which [*vide* table Ma. 8 (37)] the Coleroon commences to get a specific and registered supply over the 150 yards Calingulah: for example, the long period from 20th July to 6th September 1899, when, with the exception of only two days, 15th and 16th August, the Cauvery Dam gauge never reached that limit.

70. Unless the Coleroon does in fact obtain the unrecorded supplies I have indicated as probable, it appears to me impossible that, in such a year as 1899, the Coleroon irrigation should not have suffered in area very much more than is indicated in the diagram Ma. 9.

71. Moreover, this presumption as to unregistered but actual supply is most strongly supported by the description of the condition of Coleroon supplies given in the Metur Project, from which, for easy reference, I extract the following from paragraph 7, page 2, volume I:—

"The actual method by which the supply to the area under this anicut, that is, the flow in the Coleroon below the Grand Anicut, is fed, is not clearly traceable.

"The system of regulation in force at the Upper and Grand Anicuts only provides for passing surplus water into the Coleroon and thus the flow in this river, except in flood time, is derived from leakage through the Upper and Grand Anicuts and other surplus works, drainage from wet cultivation, leakage and percolation from the marginal lands in which the water level is in the irrigation season higher than the ordinary flow level in the Coleroon. It is found, as a fact, that, although no definite supply through works is being passed to the Coleroon, there is always an adequate supply in that river for the Lower Anicut system when the supplies in the Cauvery system are adequate. . . . . ."

72. But quite apart from this supply, which I repeat is unregistered so far as the Cauvery Dam records are concerned, the condition of regulation at the Lower Anicut, as evidenced in the table, paragraph 38 of Ma. 8, shows that even the normal discharges over the Calingulah for gauges from about 5·8′ and upwards have in the past not been considered by the Madras Engineers as really necessary for the Coleroon irrigation. At this gauge, *viz.*, 5·8′ on the Cauvery Dam, the supply over the Calingulah would be about 320 cusecs, which is the limit supply which can be utilised in the Vadavar without surplusing over the Lower Anicut and so into the sea.

73. In order to utilise the supply over the Calingulah connoted by the Cauvery Dam gauge of 6·0, *viz.*, 492 cusecs, there would be similar surplusing of 1,802 cusecs into the sea, and with that due to the limit 6·5′ of the award under issue 2 (*b*), *viz.*, 1,030 cusecs, the wasteful surplus would have risen to as much as 23,434 or appreciably more than the whole limit flow under the Award.

74. In face of this evidence and in view of the interpretation of the Arbitrator's ruling on the legal issues given in A.E. II, paragraph 185 (5), it is difficult to

see how Madras could possibly hope to establish a claim for any specific supply for the Coleroon over and above that connoted by the limit award, a very large portion of which always has been, and still must be, of the nature of avoidable waste as defined in the note A.E. II, paragraph 185 (5), due to the defective conditions of the Madras work.

75. Once again, I would point out the very large margin of safety in respect to the Coleroon irrigation supplies which the Madras Government have ready to their hand if ever it is considered desirable to render it effective.

76. In all these circumstances, I find it impossible to support the Madras contention regarding the necessity for any further specific supply for the Coleroon irrigation in the shape of flood increments or other than that already included in the award under issue 2 (*b*).

76(*a*). That the Coleroon will continue to get such increments under any assumed conditions of impounding at Kannambadi is, however, a physical fact which I have already sufficiently demonstrated.

Consideration of evidence as to proper proportion factor to be adopted.

77. The other important point I have to examine is that of the proportion factor to be fixed tentatively for the purpose of any further examination considered necessary of the working of the Kannambadi Reservoir under issue 3 (*a*) so far as it will affect this issue, and the rules for working, and the award under issue (4). As will be made quite clear in the course of this discussion, this factor consists of two components, (*a*), the proportion of the Cauvery supply which comes from the Kannambadi, and (*b*), the percentage of this supply which is required to cover loss in transmission, the two together making up the proportion which a given supply at Kannambadi bears to the total Cauvery supply of which it is a component. With regard to this, evidence put in by either party is briefly indicated as follows.

77(*a*). In Ma. 10 (9), the matter is generally discussed and the difficulty of fixing a value for the proportion factor, which, while not prejudicing Madras, would not unduly restrict impounding in Mysore is pointed out. And in Ma. 10 (24) it is suggested that, while tentative figures may be accepted for present purposes of examination, the final fixing of this factor must depend on further observations: as to this all concerned are in complete agreement.

78. The importance and difficulties attending the final determination of this matter are also very clearly put in Ma. 10 (35). "It is a matter involving many technical considerations . . . and quantities of water quite sufficient to make the difference between a fair year and bad one to Madras, while, on the other hand, it might suffice to make the difference between failure and success of the Mysore reservoir project": this also may be admitted without reservation.

79. In Ma. 10 (42), the difficulties attending the problem owing to variation in times of transmission for floods of different volume is alluded to; and it is no doubt the case that as the volume increases the time of transmission decreases.

80. In Ma. 10, paragraphs 48 and 50, the variation in the value of loss in transmission, which of course is a factor in the problem of fixing a correct proportion, is pointed out, and also its relatively greater importance in the south-west than in the north-east monsoon supplies. The foregoing discussion is summed up in Ma. 10, paragraphs 51—53, and a table is prepared comparing Sivasamudram and Upper Anicut discharges for various periods.

81. In Ma. 10, paragraph 60, the probabilty of the loss in transmission being proportionately less for larger volumes than it is for smaller is also brought to notice. This also is scarcely open to question.

82. All this matter, and its very able treatment by Madras, deserves the most careful consideration before fixing a tentative figure, even though it is admitted that the tentative figure must ultimately be subject to modification in accordance with further observations.

83. The matter is also generally discussed in My. 8 and it is pointed out in paragraph 89 that, as the transmission losses exhibited by Madras comprise the

draw-off for intermediate irrigation, which is within certain limits a more or less fixed quantity, its inclusion might tend to exaggerate the percentage of loss in transmission due to other causes; while in paragraph 89 the admission is made that further observations are necessary to determine its real value, and paragraph 91 defines the data which Mysore consider should be taken into account in making the further observations necessary to determine it.

84. Thus it is amply clear that both parties agree as to the doubtful value of any of the tentative proportions which they suggest for purposes of the present examination, or for use pending their reconsideration as data become available; and of the necessity for further observations to fix it finally.

85. In the more specific evidence now put in on this point by either party, in Ma. 24 (17), (18), factors ·65 and ·425 are suggested as the most suitable to adopt for the south-west and north-east monsoons, respectively, for the proportionate system; and ·70 and ·45 if the Mysore system is adopted in spite of the Madras objections to it.

86. In My. 21 (5) and (6) reasons are adduced by reference to statement (*a*) comparing the computed flow at Kannambadi with Cauvery Dam actuals, on the strength of which they suggest ·625 and ·3 for the two monsoons, respectively, if the compensation water is omitted from the Mysore system, and ·555 and ·25 if it is included in the Mysore system.

87. In My. 10 (13) further references and arguments are advanced on the basis of statement (*a*), but there is no fresh evidence throwing any new light on the matter. In Ma. 26 Madras contest the Mysore arguments and figures on the basis of the Dhanakere observed discharges of August and September last, which, as exhibited in Madras Appendix X, show actual losses computed daily, weekly, and for the whole period of three weeks, between the observed discharges at Dhanakere and the records at Cauvery Dam.

88. The general result of this exhibit, which is, I may note, the most reliable contribution to the evidence and discussion on this point, is that the average loss for the period between Dhanakere and Bhavani bridge was 15·2 per cent while the loss between Dhanakere and the Upper Anicut was 14·1 per cent, only, showing that there was a material contribution during this period from the Bhavani catchment; and that this contribution was greater for the first week when the supplies were higher than it was for the other two weeks of river supply; thus generally supporting the general opinion on this point, and the Mysore contention against the Madras proposal to exclude the Bhavani contribution from consideration, referred to in paragraph 12.

89. Another point which is established is that the percentage of loss is in inverse ratio to the discharge, that is to say, that it is less for the first week when the discharge was highest than it was for the second or the third week when the discharge was lower, thus supporting the general suggestion made by Madras on this point referred to in paragraph 81 above.

90. But perhaps the most important inference to be drawn from the figures is that, for stages of the river flow approaching the limit 22,750 millions cubic feet at the Cauvery Dam, the value of this transmission factor or factor of loss, *viz.*, the "f" in equation (1), paragraph 10, may very possibly change from *plus* to *minus*.

91. Now generally with regard to the arguments of either party on this subject of tentative proportion factor, neither of them appear to have fully realised the significance of the fact that, under any rules for impounding which it is possible to propose under the award on issue 2 (*b*), the limit flow must be assured; and therefore that the proportion factors to be fixed tentatively now, and by further observations later, are the proportions at Cauvery Dam and at Kannambadi of the Kannambadi contributions at and above the stage of limit flow only.

No proportions for the stages of the river lower than the limit flow can possibly affect the principles of impounding, which is the issue before us, as all supplies whatever below that limit have to be sent down unrestricted and no proportion of them can be impounded.

92. Consequently, some of the arguments on the evidence put in in this connection by either party, by Madras dealing with losses at lower stages of river flow,

and by Mysore dealing with the factor based on total yearly flow, are not strictly relevant to the issue, although the evidence has been of material assistance to me, as will be seen later, and I trust this reference and acknowledgment will absolve me from the necessity of noting on it in further detail except so far as I use it in the following calculations.

93. The following table shows the losses reckoned on the Cauvery Dam discharge abstracted from Madras Appendix X referred to in paragraph 87 for the three weeks as well as on the average for the whole period. As will be seen the result for the second week is not quite consistent.

Week	Average daily supplies at Cauvery Dam.	Loss from Sivasamudram.	Loss from Kannambadi.
First	12,723	8·76	12 per cent
Second	9,934	17·56	24 ,,
Average of all these weeks ...	8,812	14·10	18 ,,
Third	5,207	20·61	27 ,,

and figure (i) in Appendix XX shows the indication as to the probable change in the algebraic value of "f" which I alluded to in paragraph 90.

94. If the figures in column 3, which are percentage losses between Sivasamudram and Cauvery Dam reckoned on the Cauvery Dam supply, be increased in the proportion 260/200 to allow for the longer distance from Kannambadi—*vide* Ma. 10 (41)—we get a reasonable estimate based on specific data of the percentage losses between Kannambadi and the Cauvery Dam reckoned on the Cauvery Dam gauges for the stages of flow shown. But it must be remembered that all these losses are for stages of the river much lower than the limit flow, and, by analogy, the percentage losses at that higher stage of flow will be considerably less.

95. The only records we have in evidence for stages of river flow over the limit are those for the group of seven days in July—*vide* A. E. Appendix XIX, where the loss between Sivasamudram and Cauvery Dam for a limit flow of 2,607 millions cubic feet per day is shown to be 10 per cent on the Cauvery Dam flow. This increased in the ratio of 260/200 would give 13 per cent as the percentage of losses from Kannambadi. From these two sets of figures and by means of the diagram figure (ii), Appendix XX, I arrive at an estimated value for percentage of losses between Kannambadi and Cauvery for the stage of the river at limit flow as 17·5 per cent reckoned on the Cauvery Dam flow. Thus, if P × C = the contribution from Kannambadi received at the Cauvery Dam at limit flow, C being the limit flow, and P the percentage of it due to Kannambadi, then the quantity to be sent down from Kannambadi to ensure that contribution at Cauvery Dam would have to be increased by 17·5 per cent to give its proper share of the limit flow at Cauvery Dam. Or, in other words, the quantity to be sent down from Kannambadi would be $\{P+(\frac{(P\times 17\cdot 5)}{100})\}\times C$.

96. The next point for consideration is what proportion of the supply at the Cauvery Dam at the limit flow stage is due to the Kannambadi catchment and what proportion is due to the other catchments.

In Appendix A. E. X, calculations of the average south-west monsoon yield give the following proportions as coming from the various catchments :—

From Kannambadi	48 per cent.
,, Kabbini	30 ,,
,, Bhavani	15 ,,
,, Others	7 ,,
Total at Cauvery Dam ...	100 ,,

96-A. The total south-west average flow connoted at the Cauvery Dam is 422,845 millions cubic feet, and counting the south-west monsoon as from 15th June to end of September or, say, roughly 100 days, the average daily flow connoted is 4,228 × 11·5 = 48,622 cusecs, say, 50,000 cusecs. I do not think it is unreasonable to suppose that the same ratios as obtain for the average of the whole flow will not differ very materially for the stage of the river corresponding to the average daily flow.

97 For lower stages of the river flow, I see no reason to suppose that the ratio of the Kannambadi and Kabbini will vary very much as these catchments are

adjoining, and share much the same rainfall—*vide* map A. E. Appendix VII. I have shown above in paragraph 88 that the Bhavani probably contributes something even at such low stages of flow as from 5,000 to 10,000 c. f. s. at the Cauvery Dam, but I think there is no doubt but that the ratio of these contributions from below Sivasamudram at about the limit flow are considerably lower than those given in paragraph 96. I therefore assume a reduction of 30 per cent in the combined yield of these catchments, which would reduce the combined percentage of their contributions at the Cauvery Dam from 22 per cent to 15 per cent leaving 85 per cent for the combined yield from the Kabbini and Kannambadi, which distributed between them in the ratio of 48/78, and 30/78 would give the Kannambadi share of limit flow at the Cauvery Dam as 52 per cent and the Kabbini as 33 per cent.

98. Adding the 17·5 per cent for estimated losses at limit flow—*vide* paragraph 93—the quantity of water required at Kannambadi to give its due share of 52 per cent of the Cauvery Dam supply at limit flow would be 61 per cent of the limit flow at the Cauvery Dam.

A similar calculation to this, though not so detailed and in round figures for convenience of calculations, was the basis of the factors I assumed in my illustration in part II.

99. Turning now to the tables, Ma. 26, showing the proportion the half-monthly yield of Kannambadi bears to that of the Aganda Cauvery; there are, as already indicated, so many uncertain and assumed factors in the Kannambadi gaugings that the figures cannot be accepted as final, and must be used with due reservation, eliminating such percentages, as for instance, June 2, 1902, when supplies are very much below the limit flow, and remembering that it is only the proportion at limit flow which really counts.

In the following group I have selected all those half-months in which the Cauvery flow most nearly approaches the limit flow which will vary from $15 \times 1{,}966 = 30{,}000$ millions cubic feet nearly to $16 \times 1{,}966 = 32{,}000$ millions cubic feet, nearly, according as the month of 31 days is divided. This group is as follows:—

Year	Half-month	Percentage of Kannambadi flow to that of Cauvery
1902	August ... 1	45
1903	August ... 2	56
	September ... 1	43
1904	August ... 2	56
1905	July ... 1	42
	August ... 1	51
1906	August ... 1	42
1907	July ... 1	52
	September ... 1	47
1908	August ... 2	55

99-A. It is true that in certain half-months some of the stages of flow give higher percentages in higher stages of flow, while the contrary is generally expected in such, for example, as—

Year	Half-month	Percentage of Kannambadi flow to that of Cauvery
1902	July ... 2	72
	September ... 1	68
1908	July ... 2	69
	August ... 1	63

But the flow of the Cauvery during these periods was so great that it would not have reduced the Madras irrigation supplies below the standard even if the whole of the Kannambadi flow were impounded, which would have been in most of the cases impossible, as, for example, the Kannambadi flow in July (1), 1902, was

more than the whole capacity of the reservoir, which must therefore have surplused, while it is also very improbable that it would have held back the whole flow of September (1). Similarly, in 1908, the July (2) and August (2), flow at Kannambadi were both in excess of the actual capacity, but, even apart from this fact, the balance of flow left to the Cauvery Dam in three of the half-months was so much in excess of the half-monthly limit flow of from 30,000 millions cubic feet to 32,000 millions cubic feet and the half-monthly standard flow of about 25,000 millions cubic feet that it is clear that the irrigation supplies would not have suffered.

100. Moreover, as a set-off against the higher stages giving higher percentages referred to in the last paragraph, there are other similar high stages where the percentage is lower, for example—

Year	Half-month	Percentage of Kannambadi flow to that of Cauvery
1903	July ... 2	43
1904	July ... 2	42
	July ... 2	42
1905	July ... 2	56
1906	August ... 1	42

101. Now the percentages given in these three groups are to be compared with the percentage of 61 which I have computed on an entirely different and independent basis in paragraph 98 above and always remembering the doubt attaching to the various arbitrary assumptions underlying the Kannambadi discharges which are given in the statements, it cannot be said that there is anything in them which can be considered to throw any doubt on the correctness of my estimate of 61 per cent, at any rate to suggest that it is too low.

102. On the contrary, the percentages in group 1, which are those of the river flow at the Cauvery Dam, most nearly approaching the award limit, can only be held to give it very material support.

103. Turning now to the figures for the north-east monsoon, it will be seen that, whenever they approach the limit flow at Cauvery Dam, the percentages range much lower than for the south-west and conform generally to the rule that the higher the discharge, the lower the percentage. For example, the percentages for stages approaching limit flow are as follows:—

Year	Half-month	Percentage of Kannambadi flow to that of Cauvery
1902	October ... 1	21
	,, ... 2	18
	November ... 1	22
1905	October ... 2	35
1906	October ... 1	22
	,, ... 2	22

While, as examples of flow higher than the limit, the following are abstracted:—

Year	Half-month	Percentage of Kannambadi flow to that of Cauvery
1902	December ... 1	29
1903	October ... 1	24
	,, ... 2	21
	November ... 1	12
	,, ... 2	24
	December ... 1	23

And I think it will be admitted that there is nothing in these figures to justify any apprehension that a tentative proportion of, say, 30 per cent for the north-east monsoon for the flow at Kannambadi calculated to give 26 per cent at the Cauvery Dam or practically half the values estimated for the south-west monsoon, could in any sense prejudice Madras supplies at this season. It is perhaps scarcely necessary to repeat that percentages of flow for stages materially less than the limit flow cannot possibly affect the factor of proportions at the limit flow stage.

104. The calculations I have made for the south-west monsoon are, it is to be understood, purely tentative, to be replaced by others more reliable when data are available as the result of actual observations. They, however, serve to show how this matter of the proportion factors should, in my opinion, be dealt with, and I submit them for the consideration of the Arbitrator as the best guide we have as deduced from the evidence now available, and it is in consideration of these calculations and the other evidence considered that I shall make my suggestions as to the tentative figures to be adopted.

105. In accepting the third or proportionate system as probably the easiest of application in default of their own proposals not being adopted, Madras have qualified their assent with the proviso that the rules for working it must be such as will give them full security as to their limit flow under the award and an ensured share of flood increments. This proviso is very clearly stated in Ma. 27 and they illustrate it in the table Ma. 25, paragraph 24, by a comparison of the shares they would get in Kannambadi surplus supplies after the Madras limit flow is secured under the Mysore system and under their own interpretation of the proportionate system.

Mysore, on the other hand, have insisted throughout that, when once the Madras claims under the Award are secured, they shall be given full facilities for impounding as much as is physically possible of the surplus flow at Kannambadi.

106. It is submitted for consideration of the Arbitrator that both those contentions are quite compatible with a fair and reasonable interpretation of the 1892 Agreement. The matter for consideration then is, how to adjust the working under any system that may be adopted, so that both these fair and reasonable contentions may be met.

107. Now, under rule 2 of the Cauvery and Vennar Regulator, 1893, the maximum irrigation supply apportioned between the two channels which, as I have shown, corresponded with the Cauvery Dam, 1882, rule III, for special or after drought regulation, amounted to 23,140 cusecs. Allowing for losses *en route* and for the discharge over the Calingulah, this would have connoted a gauge of about 6·75 Cauvery Dam, equivalent to 2,125 millions cubic feet.

	Cusecs.
Thus, 6·75 Cauvery Dam	24,650
Less required at Cauvery and Vennar maximum	23,140
	1,510
Less Calingulah	1,300
Allowance for losses *en route*	210

108. This gauge is the exact mean between the scour limits under the normal and after special drought conditions which was connoted by the operation of the Cauvery Dam rules and in my opinion is very significant as showing how closely the framers of the 1893 rules for the Cauvery and Vennar regulators were working to the quantities connoted by the 1882 rules for the Cauvery Dam, as might be expected.

109. Now, this higher gauge and flow was under the rules not required or enjoyed whenever it was in the river, but only after special or drought periods.

110. It has, as will be remembered, already been taken into account in my assessment of the limit award under clause 2 (*b*) and I propose to make further use of it in exactly the same way as it was used under the operation of the rules in the

past, and to make it practically effective in the principles I shall presently enunciate for the consideration of the Arbitrator under the present issue.

111. For the purpose of further examining these proposals before enunciating them as they will affect Madras supplies, I have worked out in Appendices XXI and XXII two sample standard tables for regulation of impounding at Kannambadi, the one, Appendix XXI, being based on the Mysore system which would allow full facilities consistent with physical limits for impounding, while ensuring at all times the 1,966 millions cubic feet flow at Cauvery Dam; and the other, Appendix XXII, being based on the Madras proposals for the third or proportionate system, as they have understood it, which would require the limit flow due from Kannambadi to be passed on at all times irrespective of what was reaching the Cauvery Dam from other sources.

112. In preparing these tables I have adhered to the proportion factors of 60 per cent at Kannambadi giving 50 per cent of the limit flow at the Cauvery Dam which I used in my former illustration in A.E., Part II.

The difference as between these factors and those I have deduced by calculations as given in paragraph 98, is very small and as will be seen by very cursory study of the tables would not very materially affect the results that would be obtained with the higher factors.

The tables are purely for purposes of examination and will have to be modified to suit the tentative amended proportions which are to be adopted for present purposes, as also the final proportions when fixed by further observations of actual data, if the Kannambadi Reservoir is found to be permissible under the Award under issue (4).

113. As will be seen, by means of these tables, the flow at Kannambadi on any day being known, the quantity to be passed on to Cauvery Dam, and that of permissible impounding, are also known.

The question of time of flow between Kannambadi and Cauvery Dam may be eliminated as all water leaving Kannambadi must reach Cauvery Dam; and whether the period is three or four days, or more, or less, is immaterial in this system if adequate precautions are provided.

114. In preparing these tables, in order to eliminate doubtful factors as far as is possible, I have set aside the estimates of Kannambadi flow used in the examination of the matter by either party already discussed, and make my sole reference the actual gauge records of the Cauvery Dam as given in Volume III, Metur Project; thus the only assumptions made are the proportion factors for calculating the corresponding Kannambadi flow and the loss in transmission which I have already defined.

115. In making this examination, I do not propose to consider the effect on the Madras supplies monthly or half-monthly, as the examination under this head given above of the results as presented by either party on the working tables prepared by them is quite sufficient in the circumstances of the several doubtful assumptions on which they are based.

116. In this connection, I would point out that the effect of impounding can best be logically examined if attention is confined to periods during which it occurred, because impounding cannot possibly affect supplies when there is anything less than the limit flow available in the river. Thus the deficient supplies from 18th July to 6th September in 1899, the worst year on record, would have been absolutely unaffected by impounding, and there is no doubt but that the large deficit in area of irrigation in the delta in that year was due to those natural conditions—*vide* paragraph 174, A.E., Part II; but these conditions would have been absolutely unaffected by impounding. That, if the Kannambadi Reservoir is allowed, the delta irrigation will continue to be subject in future to similar fluctuations due to similar defective natural conditions as were experienced in 1899, is quite certain, but it is equally certain that, if impounding is confined only to the periods when the natural flow in the river is more than sufficient to ensure the limit flow under the award 2 (*b*) and is regulated so as not to reduce this limit flow at the Cauvery Dam, it cannot be held to affect naturally deficient supplies which will be absolutely untouched.

117. Now, under the Award under 2 (*b*), it follows that the impounding at Kannambadi must not be allowed to affect the Cauvery Dam flow except on days when the Cauvery Dam gauge due to natural flow is in excess of the 6·5′ limit. The contribution from Kannambadi to the discharges connoted by these gauges would have passed Kannambadi two or three or four days earlier, but this does not affect the calculations.

118. Tables in Appendix XXIII have been worked out from the standard table, Appendix XXI, as being that most unfavourable to Madras, and for the four worst years on record, the primary object in this examination being to enable me to enunciate principles for consideration of the Arbitrator, if it is possible to do so, which will fully safeguard Madras interests.

119. The results are abstracted in Appendix XXIV. As will be seen, impounding could only have occurred at Kannambadi during the periods shown in column 1 and it was confined entirely to the south-west monsoon in each of these bad years. Column (4) shows the amounts that would have been held back from the Cauvery Dam and column (5) shows the quantities of water which were actually surplused at the Upper Anicut during the same periods. These quantities, of course, do not include the supply passing over the 150 yards Calingulah. It is to be noted that in every case these quantities actually surplused by Madras, as proved by the records, exceed the quantities reduced by impounding, that is to say, that, even after impounding at Kannambadi under table, Appendix XXI, there would still have been surplus supplies in excess of what she actually used for irrigation, which surplus would still have passed into the Coleroon, and very largely into the sea—paragraph (73).

120. Further, the resulting flow in every case fully equals the irrigation supply due to Madras under the award limit, and in most cases is more than this, owing to flood increments. This is only one more practical demonstration of the physical fact already brought to notice and its effect on Madras supplies. Finally, the supplies actually received after impounding were in every case in considerable excess over the standard supplies required as given in paragraph 41.

It may be noted for the satisfaction of Madras, and of the irrigators of the delta both in Madras and French territory, and for consideration of the Arbitrator, that any re-adjustment of the proportion factors, which may be found necessary when complete data are availabe for finally fixing them, cannot possibly alter the figures in column 9, Appendix XXI, from which these results have been demonstrated.

As it affects Mysore, too, it may be noted that any re-adjustment of the proportion factor cannot alter the general character of these results. As projected, her reservoir would probably only partially fill in such years as 1899 and 1905 which, from the records in evidence, are likely to occur on an average of about one in ten.

120-A. In Ma. 27 (9)-(10) it is urged that, in years of bad supply such as those under examination, any reduction of supplies below what they actually enjoyed in those years must tend to still further extensive loss in crop outturn than was then experienced; and they refer specially to the evidence contained in the jamabandi reports as given in Ma. 20. In paragraph 12 this apprehension is stated as follows:—the Mysore system would "entail on Madras enhanced losses as compared with those now suffered on account of deficient supplies in bad years." I had referred generally to this matter in my Examination of Evidence, Part II, paragraphs (171)—(176) when considering the probable effect on supplies of impounding in these bad years before giving my opinion as to limit flow under Award 2 (*b*). The safeguard which should satisfy the Madras apprehension stated above, is, as already pointed out in paragraph 117, that impounding at Kannambadi, if allowed at all, cannot possibly be allowed to affect natural supplies below the awarded limit; and as this limit has been fixed with due regard to irrigation requirements, it follows that impounding cannot have any effect on the supplies below irrigation requirements, to which the losses in crop out-turn in bad years were doubtless partly due. In this connection I wish to draw very special attention to the further examination I have made of this matter as it affects the four bad years in Appendix XXV which, read in connection with the foregoing examination of results of impounding under the system discussed in paragraphs 119 and 120, should, I submit, altogether allay the apprehension entertained by Madras as to there being any risk of losses which are entirely due to natural conditions being in any way enhanced by impounding if properly regulated.

121. In Appendix XXIII-A, I have worked out results similarly from table XXII, illustrating the working for the worst year only, 1899-1900.

122. A comparison of the figures in columns 4 and 5 of Appendix XXIII with those in the same columns of Appendix XXIII (*a*) as given in the following table :—

Periods	Actually surplused under existing conditions, column 4, Madras project	Reduction of figures in column 2, due to impounding in table XXI	Balance still left surplus, columns 2—3	Reduction of figures in column 2 due to impounding under table XX_I	Balance still left surplus, columns 2—5	Extra waste under XXII difference of column 6—4
1	2	3	4	5	6	7
June	11,860	8,565	3,315	4,500	7,380	4,065
July	18,052	12,075	5,977	6,126	11,926	6,949
September	7,054	3,236	3,818	1,561	5,493	1,675
Total ...	36,986	23,876	13,110	12,187	24,799	11,689

will show that, while impounding under the first method would have left considerable surpluses, impounding under the second method would have left still larger surpluses, the greater part of which in both cases, as already shown in paragraph (73), would have been wasted at the Lower Anicut due to the defective conditions which obtain there for controlling available supplies.

123. The following table compares the difference in the effect on the Mysore storage for the same period:—

Periods	Quantities impounded by Mysore under XXI	Quantities impounded by Mysore under XXII	Difference of loss to Mysore
1	2	3	4
June	10,276	5,397	4,879
July	14,496	7,257	7,239
September	3,884	1,869	2,025
Total ...	28,656	14,523	14,133

And it will be seen that the benefit to them of the impounding under table XXI would have been very considerable.

124. The combined effect of the years working on Madras or Mysore supplies by impounding under table XXII would be that, while the amount surplused a large part of which would have run waste to the sea from the Madras supplies would be increased by 11,689 millions cubic feet, the reduction in the Mysore useful supplies would be no less than 14,133 millions cubic feet.

125. I submit, for the consideration of the Arbitrator, that under no fair and reasonable interpretation of the 1892 Agreement could such conditions be upheld under the award already given on the legal issue. I shall therefore presently propose, for consideration of the Arbitrator, principles of working based generally on regulation under table XXI with such precautions as appear necessary to prevent any risk to the limit flow due under 2 (*b*) being impaired, and any interference with necessary irrigation supplies.

126. The precautions which I propose to introduce into the principles of working in order to safeguard Madras against any risk of the possible slight interference which was illustrated in the systems examined by them, and which it is necessary

to guard against in the system now to be suggested for consideration of the Arbitrator, are as follows:—

(1) To raise the proportion factor for the south-west monsoon from 61 per cent, as calculated by me, paragraph 98, to 62·5 of which 80 per cent would be estimated to reach the Cauvery Dam, thus allowing for the higher proportion of 25 per cent reckoned on the Cauvery Dam flow for loss *en route* as against that calculated as 17·5 per cent in paragraph 93.

(2) In the south-west monsoon, after special or drought periods, *i.e.*, when the Cauvery Dam gauge has not exceeded 6·0′ for a given period, to regulate impounding at Kannambadi under a standard table prepared on the lines of Appendix XXII until the flow at Kannambadi reaches the limit of $\frac{2,125 \times 62·5}{100}$ = 1,330 millions cubic eet calculated to give a flow at the Cauvery Dam equal to the 2,125 millions cubic feet as calculated in paragraph 107 and to continue it under the same table for a further period of twelve hours. This period of twelve hours is calculated to cover the time it probably took to open the scouring sluices fully—*vide* paragraph 82, A.E., Part II; thereafter regulation is to be under a standard table prepared on the lines of Appendix XXI. These two precautions will, in my opinion, fully safeguard Madras against any risk of the limit flow under award 2 (*b*) ever being reduced whenever it is available in the river due to any natural fluctuations from the factor, and will also eliminate any risk of the very small interference with necessary irrigation supplies such as that referred to in my examination of the Mysore proposals for working—*vide* paragraph 63. As it takes probably from three to four days for Kannambadi supplies to reach Cauvery Dam at the limit stage of flow, the criterion of special or drought conditions would be, in consistence with rule III of Upper Anicut rules of 1882, that, when in a period of four days preceding impounding the Cauvery Dam gauge had not exceeded 6·0′, impounding at Kannambadi should be under table XXII until the higher flow limit was reached as above described. While, if during the preceding four days, 6·0′ had been exceeded on the Cauvery Dam, impounding would proceed on the lines of Appendix XXI.

127. These precautions, I submit for consideration of the Arbitrator, are, as judged by the examination of the working under the lower factors—paragraphs 118 and 120, quite sufficient to give the margin of safety required, and conform with the essential principle on which both parties are in agreement—*vide* paragraph 24-A.

128. I may now proceed to enunciate, for the consideration of the Arbitrator, the principles which, from the foregoing examination of the evidence, appear to me to be the best for adoption as the award under the present issue, and in accordance with which rules should be framed. These are as follows.

Principles of working suggested by Assessor for consideration of the Arbitrator.

129. (A) Daily gauges at the Cauvery Dam and details of flow and gauges at Kannambadi such as will clearly show the working of the reservoir both as to inflow and outflow, should be telegraphed daily by each party, respectively, to the other party.

(B) Standard tables should be worked out for all stages of the Kannambadi flow above the limits for the south-west monsoon of $\frac{62·5 \times 1,966}{100}$ = 1,230 millions cubic feet approximately, of which 80 per cent is estimated to reach the Cauvery Dam, and for the north-east monsoon of $\frac{30 \times 1,966}{100}$ = 590 millions cubic feet approximately, of which 83 per cent is estimated to reach the Cauvery Dam. These tables should be worked out on identical lines as those given in Appendix XXI and Appendix XXII, the essential principles being that impounding at Kannambadi under Standard Table I will be regulated so as to maintain the limit flow at the Cauvery Dam as is shown in the sample, Appendix XXI, while, under Standard Table II, regulation of impounding at Kannambadi will be restricted as is shown in the sample, Appendix XXII.

In the south-west monsoon no impounding should be permitted until the flow at Kannambadi exceeded $\frac{62·5 \times 1,966}{100}$ = 1,230 millions cubic feet, approximately. And

no impounding in the north-east monsoon should be permitted until the flow at Kannambadi exceeded $\frac{30 \times 1,966}{100} = 590$ millions cubic feet, approximately. These limits being the computed contributions, inclusive of losses *en route*, from the Kannambadi catchment to the limit flow at the Cauvery Dam under award 2 (*b*), for each monsoon.

Impounding in the south-west monsoon should be allowed to commence under table I if at any time during the preceding four days the Cauvery Dam gauge had exceeded 6·0′, while, if at any time during the preceding four days, it had not exceeded 6·0′, impounding should be restricted to table II until the Kannambadi inflow reaches the equivalent value in cubic feet a second corresponding to 1,330 millions cubic feet in 24 hours, when it should be continued under table II for a further twelve hours, and should thereafter continue under table I.

It is to be understood that the figures herein given of limit flow at Kannambadi are based on the tentative factors now proposed, and are to be subject to final adjustment when necessary data are available.

M. NETHERSOLE,
Assessor.

21*st April* 1914.

APPENDIX A. E. XVII.

Estimate of surpluses available after provision of the irrigation supplies corrected to the limit flow under the Award on issue 2 (*b*).

Year.	Amended total natural flow of Aganda Cauvery—column (4) of A. E. VII.	Yearly total of natural discharge limited to 1,966 m.c.ft.—column (2) of Ma. 24 (*c*).	Amended surplus available.
1	2	3	4
1896-97	749,828	291,386	458,442
1897 98	687,272	274,169	413,103
1898-99	483,002	302,688	180,314
1899-00	210,524	151,560	58,964
1900-01	715,898	249,435	466,463
1901-02	471,404	286,394	185,010
1902-03	431,802	264,808	166,994
1903-04	744,984	330,867	414,017
1904-05	358,409	200,909	157,500
1905-06	247,489	177,696	69,793
1906-07	389,721	219,640	170,081
1907-08	470,293	231,579	238,714
1908-09	335,295	176,913	158,382

APPENDIX A. E. XVIII.

Statement showing effect of flood increments to irrigation supplies on the quantities shewn by Madras as "losses."

Month	Half-monthly supply limited to 1,966—column 3, Ma. 21, table XII.	Diminution or loss claimed as such by Madras—column 4, table XII.	Half-monthly supply limited to 2,300—column 3, Ma. 25-A 1-13 (*c*).	Remarks.
1	2	3	4	5
1899.				
June ... .. (2)	19,106	202	21,045	Loss more than covered by flood increments.
August ... ... (1)	6,868	273	6,868	Loss not covered—material.
1905.				
September ... ... (2)	13,649	988	13,649	Loss not covered—immaterial.
October ... ... (2)	13,377	725	13,377	Do.
1905.				
July ... ... (1)	24,639	214	27,020	Loss more than covered.
(2)	22,260	348	24,932	Do.
August ... ... (1)	20,437	161	21,937	Do.
(2)	14,449	60	14,449	Loss not covered—material.
September ... ... (1)	21,009	22	21,416	Loss more than covered.
1908.				
July ... ... (1)	20,574	393	23,537	Loss more than covered.
(2)	29,608	596	40.265	Do.
August ... ... (2)	26,404	90	28,002	Do.

In the above statement material and immaterial loss is to be read as defined in paragraph 46, A. E. Part III.

APPENDIX A. E. XIX.

STATEMENT showing percentage of losses between Sivasamudram and Cauvery Dam reckoned on Cauvery flow.

Month	Number of days	Average flow at Sivasamudram	Average flow at Cauvery	Loss between Sivasamudram and Cauvery	Percentage of loss on Cauvery flow
1	2	3	4	5	6
1902.					
June	4	2,103	1,166	937	80·4
September...	3	2,498	1,852	646	34·9
Do	7	2,028	1,897	129	6·8
1903.					
August	5	2,140	1,852	288	15·5
September	2	2,337	1,937	400	20·6
1904.					
July	7	2,868	2,607	261	10·0
Do	6	2,260	1,797	463	25·7
August	4	2,076	1,474	602	40·8
Do	11	2,150	1,334	826	62·4
September	6	2,278	1,291	987	76·4
Do	3	1,854	1,069	785	73·4
1905.					
June	3	1,903	1,319	584	44·2
July	2	1,879	1,432	447	31·2
August	7	1,953	1,420	533	37·5
Do	9	1,901	1,367	534	39·0
September	4	1,880	1,383	497	36·0
Do	12	1,271	968	305	31·6
1906.					
June	3	1,901	915	986	107·7
September	3	1,645	1,203	442	36·7
1907.					
June	6	1,979	1,549	430	27·7
September	2	1,535	1,180	355	30·0
1908.					
July	9	2,088	1,734	354	20·4
August	15	1,495	1,691	254	15·0
1909.					
July	5	2,119	2,034	85	4·1
August	4	1,790	1,558	232	15·0

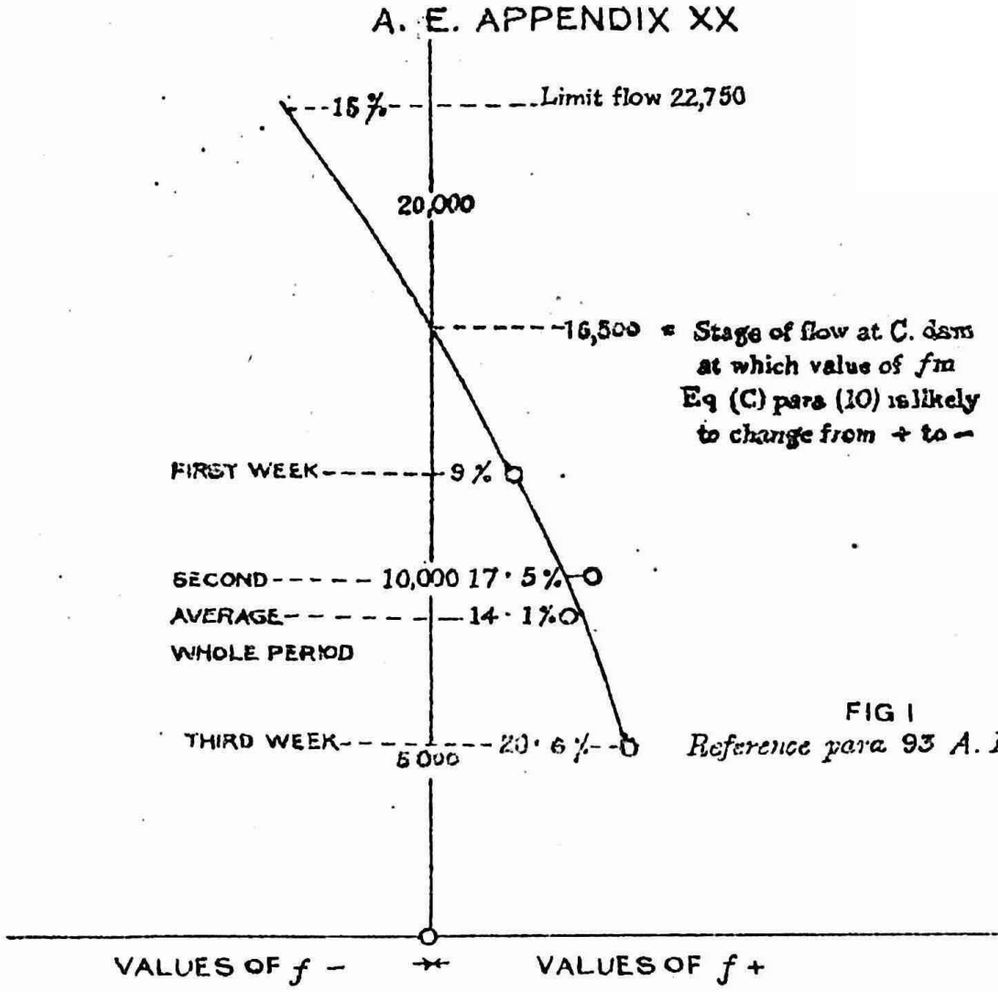
15 %
Limit flow 22,750
20,000
16,500 = Stage of flow at C. dam at which value of fm Eq (C) para (10) is likely to change from + to −
FIRST WEEK 9 %
SECOND 10,000 17·5 %
AVERAGE 14·1 %
WHOLE PERIOD
THIRD WEEK 5,000 20·6 %
VALUES OF f −
VALUES OF f +

FIG I
Reference para 93 A. E. III

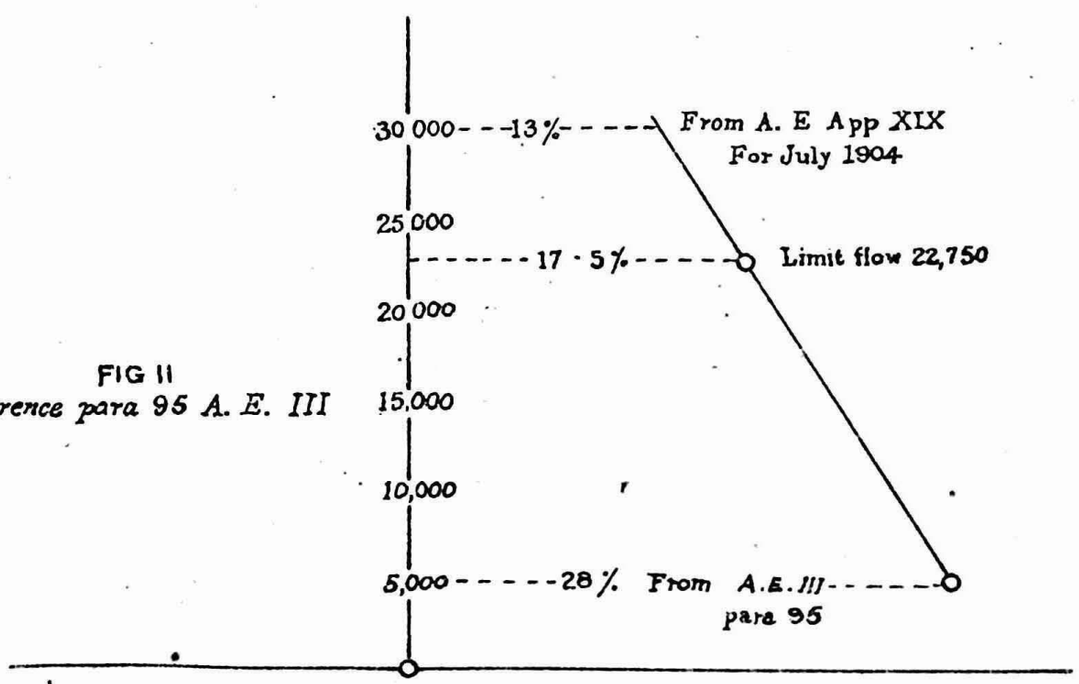

FIG II
Reference para 95 A. E. III

APPENDIX A. E. XXI.

SAMPLE table for regulating impounding at Kannambadi ensuring the limit. flow only at the Cauvery Dam column 9 up to the point at which it must be exceeded due to natural causes.

Gauge	Cauvery Dam natural flow	From Kannambadi	From other sources	Natural flow Kannambadi	Impounded	Passed on	Value at Cauvery	Total at Cauvery after impounding	Amount held back from Cauvery
1	2	3	4	5	6	7	8	9	10
6·5	1,966	983	983	1,180	...	1,180	983	1,966	...
6·6	2,020	1,010	1,010	1,212	65	1,147	956	1,966	54
6·7	2,090	1,045	1,045	1,259	154	1,105	921	1,966	124
6·8	2,160	1,080	1,080	1,296	233	1,063	886	1,966	194
6·9	2,230	1,115	1,115	1,338	317	1,021	851	1,966	264
7·0	2,300	1,150	1,150	1,380	401	979	816	1,966	334
7·1	2,415	1,208	1,208	1,450	540	910	758	1,966	449
7·2	2,530	1,265	1,265	1,518	677	841	701	1,966	564
7·3	2,645	1,322	1,322	1,586	813	773	644	1,966	679
7·4	2,760	1,380	1,390	1,656	953	703	586	1,966	794
7·5	2,875	1,438	1,438	1,725	1,091	634	528	1,966	909
7·6	2,994	1,497	1,497	1,796	1,233	563	463	1,966	1,028
7·7	3,113	1,556	1,556	1,367	1,375	492	410	1,966	1,147
7·8	3,227	1,614	1,614	1,937	1,515	422	352	1,966	1,261
7·9	3,346	1,673	1,673	2,008	1,645	353	293	1,966	1,380
8·0	3,470	1,735	1,735	2,082	1,801	281	231	1,966	1,504
8·1	3,598	1,799	1,799	2,159	1,959	200	167	1,966	1,632
8·2	3,726	1,863	1,863	2,236	2,112	124	103	1,966	1,760
8·3	3,854	1,927	1,927	2,312	2,265	47	39	1,966	1,888
8·4	3,982	1,991	1,991	2,389	2,389	.....	.....	1,991	1,991
8·5	4,110	2,055	2,055	2,466	2,466	.....	.....	2,055	2,055
8·6	4,238	2,119	2,119	2,543	2,543	.....	.....	2,119	2,119
8·7	4,366	2,183	2,183	2,619	2,619	.....	.....	2,183	2,183
8·8	4,494	2,247	2,247	2,696	2,696	.....	.....	2,247	2,247
8·9	4,622	2,311	2,311	2,773	2,773	.....	.....	2,311	2,311
9·0	4,750	2,375	2,375	2,850	2,850	.....	.....	2,375	2,375
9·1	4,884	2,442	2,442	2,930	2,930	.....	.....	2,442	2,442
9·2	5,018	2,509	2,509	3,011	3,011	.....	.....	2,509	2,509
9·3	5,152	2,576	2,576	3,091	3,091	.....	.....	2,576	2,576
9·4	5,286	2.643	2,643	3,171	3,171	.....	.....	2.643	2,643
9·5	5,420	2,710	2,710	3,252	3,252	.....	.....	2,710	2,710
9·6	5,556	2,778	2,778	3,334	3,334	.....	.....	2,778	2,778
9·7	5,692	2,846	2,846	3,415	3,415	.....	.....	2,846	2,846
9·8	5,828	2,914	2,914	3,517	3,517	.....	.....	2,914	2.914
9·9	5,964	2,982	2,982	3,598	3,598	.....	.....	2,982	2,982
10·0	6,100	3,050	3,050	3,660	3,660	... ..	.....	3.050	3,050
10·1	6,251	3,125	3,125	3,750	3,750	.....	.....	3,125	3,125
10·2	6,402	3,201	3,201	3,841	3,841	.....	.....	3,201	3,201
10·3	6,553	3,276	3,276	3,931	3,931	.....	.....	3,276	3,276
10·4	6,704	3,352	3,352	4,022	4,022	.....	.....	3,352	3,352
10·5	6,855	3,427	3,427	4,112	4,112	.....	.....	3,427	3,427
10·6	7,007	3,503	3,503	4,204	4,204	.....	.....	3,503	3,503
10·7	7,159	3,580	3,580	4,296	4,296	.....	.....	3,580	3,580
10·8	7,311	3,655	3,655	4,386	4,386	.....	.....	3,655	3,655
10·9	7,463	3,731	3,731	4,476	4,476	.....	.....	3,731	3,731
11·0	7,616	3,808	3,808	4,570	4,570	.....	.....	3,808	3,808

APPENDIX A. E. XXII.

SAMPLE table for regulating impounding at Kannambadi ensuring increments over the limit flow column 9 from the commencement of impounding.

Gauge	Cauvery Dam natural flow	From Kannam-badi	From other sources	Natural flow Kannam-badi	Im-pounded	Passed on	Value at Cauvery	Total at Cauvery after im-pounding	Amount held back from Cauvery
1	2	3	4	5	6	7	8	9	10
6·5	1,966	983	983	1,180	.....	1,180	983	1,966	.....
6·6	2,020	1,010	1,010	1,212	32	1,180	983	1,993	27
6·7	2,090	1,045	1,045	1,259	79	1,180	983	2,028	63
6·8	2,160	1,080	1,080	1,296	116	1,180	983	2,063	97
6 9	2,230	1,115	1,115	1,338	158	1,180	983	2,098	132
7·0	2,300	1,150	1,150	1,380	200	1,180	983	2,133	167
7·1	2,415	1,208	1,208	1,450	270	1,180	983	2,191	224
7·2	2,530	1,265	1,265	1,518	338	1,180	983	2,248	282
7·3	2,645	1,322	1,322	1,586	406	1,180	983	2,305	340
7·4	2,760	1,380	1,380	1,656	476	1,180	983	2,363	397
7·5	2,875	1,438	1,438	1,725	545	1,180	983	2,421	454
7·6	2,994	1,497	1,497	1,796	616	1,180	983	2,480	514
7·7	3,113	1,556	1,556	1,867	687	1,180	983	2,539	574
7·8	3,227	1,614	1,614	1,937	757	1,180	983	2,597	630
7·9	3,346	1,673	1,673	2,008	828	1,180	983	2,656	690
8·0	3,470	1,735	1,735	2,082	902	1,180	983	2,718	752
8·1	3,598	1,799	1,799	2,159	979	1,180	983	2,782	816
8·2	3,726	1,863	1,863	2,236	1,056	1,180	983	2,846	880
8·3	3,854	1,927	1,927	2,312	1,132	1,180	983	2,910	944
8·4	3,982	1,991	1,991	2,389	1,209	1,180	983	2,974	1,008
8·5	4,110	2,055	2,055	2,466	1,286	1,180	983	3,038	1,072
8·6	4,238	2,119	2,119	2,543	1,363	1,180	983	3,102	1,136
8·7	4,366	2,183	2,183	2,619	1,439	1,180	983	3,166	1,200
8·8	4,494	2,247	2,247	2,696	1,516	1,180	983	3,230	1,264
8·9	4,622	2,311	2,311	2,773	1,593	1,180	983	3,294	1,328
9·0	4,750	2,375	2,375	2,850	1,670	1,180	983	3,358	1,392

APPENDIX A.E. XXIII.

Estimate by the Assessor based on the Cauvery Dam records of quantities of water impounded at Kannambadi and withheld from the Cauvery for the years 1899-1900, 1904-1905, 1905-1906, and 1908-1909, under table Appendix XXI.

1899-1900.

Month and date	Gauge	Total flow, Aganda Cauvery	Impounded	Reduced from Cauvery	Resulting flow Cauvery
1	2	3	4	5	6
June 19	8·2	3,726	2,112	1,760	1,966
20	8·6	4,238	2,543	2,119	2,112
21	8·8	4,494	2,696	2,247	2,247
22	8·2	3,726	2,112	1,760	1,966
23	7·3	2,645	813	679	1,966
24	6·5	1,966	...	...	...
		20,745	10,276	8,565	...
July 3	6·7	2,090	154	124	1,966
4	8·2	3,726	2,112	1,760	1,966
5	8·6	4,238	2,543	2,119	2,119
6	8·4	3,982	2,389	1,991	1,991
7	8·3	3,854	2,265	1,888	1,966
8	8·0	3,470	1,801	1,504	1,966
9	7·5	2,875	1,091	909	1,966
10	7·1	2,415	540	449	1,966
11	6·7	2,090	154	124	1,966
12	6·5	1,966	...	...	...
13	6.9	2,230	317	264	1,966
14	7·3	2,645	813	679	1,966
15	6·9	2,230	317	264	1,966
16	6·5	...	...	...	...
		37,811	14,496	12,075	...
September 7	6·6	2,020	65	54	1,966
9	6·9	2,230	317	264	1,966
19	7·0	2,300	401	334	1,966
20	7·7	3,113	1,375	1,147	1,966
21	6·8	2,160	233	194	1,995
22	7·1	2,415	540	449	1,966
23	7·4	2,760	953	794	1,966
					1,966
		16,998	3,884	3,236	...
		1904-1905.			
June 16	7·1	2,415	540	449	1,966
17	6·8	2,160	233	194	1,966
23	7·6	2,994	1,233	1,028	1,966
24	8·8	4,494	2,696	2,247	2,247
25	8·4	3,982	2,389	1,991	1,991
26	7·3	2,645	813	679	1,966
27	7·0	2,300	401	334	1,966
28	6·7	2,090	154	124	1,966
29	6·7	2,090	154	124	1,966
30	6·8	2,160	233	194	1,966
		37,330	8,846	7,361	19,966

Estimate by the Assessor based on the Cauvery Dam records of quantities of water impounded at Kannambadi and withheld from the Cauvery—*contd.*

1904-1905—contd.

Month and date	Gauge	Total flow, Aganda Cauvery	Impounded	Reduced from Cauvery	Resulting flow, Cauvery
1	2	3	4	5	6
July 1	7·4	2,760	953	794	1,966
2	7·4	2,760	953	794	1,966
3	7·4	2,760	953	794	1,966
4	8·0	3,470	1,801	1,504	1,966
5	8·4	3,982	2,389	1,991	1,991
6	10·9	7,463	4,476	3,731	3,731
7	11·0	7,616	4,570	3,808	3,808
8	10·8	7,311	4,386	3,655	3,655
9	10·3	6,553	3,931	3,276	3,276
10	9·4	5,286	3,171	2,643	2,643
11	8·5	4,110	2,466	2,055	2,055
12	8·3	3,854	2,265	1,888	1,966
13	8·6	4,238	2,543	2,119	2,119
14	7·8	3,227	1,515	1,261	1,966
15	7·2	2,530	677	564	1,966
16	7·6	2,994	1,233	1,028	1,966
17	7·5	2,875	1,091	909	1,966
18	7·3	2,645	813	679	1,966
19	7·1	2,415	540	449	1,966
20	7·0	2,300	401	334	1,966
21	7·3	2,645	813	679	1,966
22	7·1	2,415	540	449	1,966
23	6·9	2,230	317	264	1,966
24	7·0	2,300	401	334	1,996
25	7·5	2,875	1,091	909	1,966
26	7·5	2,875	1,091	909	1,966
27	7·5	2,875	1,091	909	1,966
28	7·5	2,875	1,091	909	1,966
29	7·1	2,415	540	449	1,966
		1,04,654	48,102	40,087	64,564
August 7	7·5	2,875	1,091	909	1,966
8	7·5	2,875	1,091	909	1,966
9	7·5	2,875	1,091	909	1,966
10	7·6	2,994	1,233	1,028	1,966
11	7·5	2,875	1,091	909	1,966
12	7·6	2,994	1,233	1,028	1,966
13	7·6	2,994	1,233	1,028	1,966
14	7·5	2,875	1,091	909	1,966
15	7·5	2,875	1,091	909	1,966
16	7·5	2,875	1,091	909	1,966
17	7·5	2,875	1,091	909	1,966
18	7·1	2,415	540	449	1,966
19	6·7	2,090	154	124	1,966
		36,487	13,121	10,929	25,558
September 18	7·0	2,300	401	334	1,966
		1905-1906.			
June 25	6·6	2,020	65	54	1,966
July 2	7·5	2,875	1,091	909	1,966
3	7·4	2,760	953	794	1,966
4	7·5	2,875	1,091	909	1,966
5	7·5	2,875	1,091	909	1,966
6	7·4	2,760	953	794	1,966
7	6·6	2,020	65	54	1,966
12	7·0	2,300	401	334	1,966
13	7·5	2,875	1,091	909	1,966
14	6·8	2,160	233	194	1,966
23	7·0	2,300	401	334	1,966
24	8·8	4,494	2,696	2,247	2,247
25	9·2	5,018	3,011	2,509	2,509
26	9·3	5,152	3,091	2,576	2,576
27	8·6	4,238	2,543	2,119	2,119
28	7·7	3,113	1,375	1,147	1,966
29	7·0	2,300	401	334	1,966
30	7·0	2,300	401	334	1,966
31	7·0	2,300	401	334	1,966
		54,715	21,289	17,740	36,975

Estimate by the Assessor based on the Cauvery Dam records of quantities of water impounded at Kannambadi and withheld from the Cauvery—*concld.*

1905-1906—contd.

Month and date		Gauge	Total flow, Aganda Cauvery	Impounded	Reduced from Cauvery	Resulting flow Cauvery
1		2	3	4	5	6
August	1	7·5	2,875	1,091	909	1,966
	2	7·5	2,875	1,091	909	1,966
	3	7·5	2,875	1,091	909	1,966
	4	7·2	2,530	677	564	1,966
	5	6·6	2,020	65	54	1,966
			13,175	4,015	3,345	9,830
October	16	7·1	2,415	540	449	1,966
	19	6·6	2,020	65	54	1,966
			4,435	605	503	3,932

1908-1909.

July	6	7·5	2,875	1,091	909	1,966
	7	8·2	3,726	2,112	1,760	1,966
	8	7·3	2,645	813	679	1,966
	9	7·0	2,300	401	334	1,966
	10	7·2	2,530	677	564	1,966
	11	7·5	2,875	1,091	909	1,966
	12	6·7	2,090	154	124	1,966
	18	6·8	2,160	233	194	1,966
	19	6·7	2,090	154	124	1,966
	21	7·1	2,415	540	449	1,966
	22	7·2	2,530	677	564	1,966
	23	7·6	2,994	1,233	1,028	1,966
	24	8·3	3,854	2,265	1,888	1,966
	25	8·4	3,982	2,389	1,991	1,966
	26	8·0	3,470	1,801	1,504	1,966
	27	7·6	2,994	1,233	1,028	1,966
	28	8·2	3,726	2,112	1,760	1,966
	29	8·8	4,494	2,696	2,247	2,247
	30	8·7	4,366	2,619	2,183	2,183
	31	8·4	3,982	2,389	1,991	1,991
			62,098	26,690	22,230	39,868
August	1	8·1	3,598	1,959	1,632	1,966
	2	7·7	3,113	1,375	1,147	1,966
	3	7·1	2,415	540	449	1,966
	4	7·2	2,530	677	564	1,966
	5	8·0	3,470	1,801	1,504	1,966
	6	8·5	4,110	2,166	2,055	2,055
	7	8·9	4,622	2,773	2,311	2,311
	8	9·3	5,152	3,091	2,576	2,576
	9	9·4	5,286	3,171	2,643	2,643
	10	8·9	4,622	2,773	2,311	2,311
	11	8·6	4,238	2,543	2,119	2,119
	12	8·0	3,470	1,861	1,504	1,966
	13	7·7	3,113	1,375	1,147	1,966
	14	7·4	2,760	953	794	1,966
	15	7·3	2,645	813	679	1,966
	16	7·2	2,530	677	564	1,966
	17	7·0	2,300	401	334	1,966
	18	6·6	2,020	65	54	1,966
			61,994	29,254	24,387	37,607
October	29	7·0	2,300	401	334	1,966
January	4	7·0	2,300	401	334	1,966

APPENDIX A. E. XXIII-A.

Estimate by the Assessor based on the Cauvery Dam records of quantities of water impounded at Kannambadi and withheld from the Cauvery for the 1899-1900 under table XXII.

Month and date	Gauge	Total flow, Aganda Cauvery	Impounded	Reduced from Cauvery	Resulting flow, Cauvery
1	2	3	4	5	6
June ... 19	8·2	3,726	1,056	880	2,846
20	8·6	4,238	1,363	1,136	3,102
21	8·8	4,494	1,516	1,264	3,230
22	8·2	3,726	1,056	880	2,846
23	7·3	2,645	406	340	2,305
24	6·5	1,966	...	...	...
		20,795	5,397	4,500	14,329
July ... 3	6·7	2,090	79	62	2,028
4	8·2	3,726	1,056	880	2,846
5	8·6	4,238	1,363	1,136	3,102
6	8·4	3,982	1,209	1,008	2,974
7	8·3	3,854	1,132	944	2,910
8	8·0	3,470	902	752	2,718
9	7·5	2,875	545	454	2,421
10	7·1	2,415	270	224	2,191
11	6·7	2,090	79	62	2,028
12	6·5	1,966	...	...	...
13	6·9	2,230	158	132	2,098
14	7·3	2,645	406	340	2,305
15	6·9	2,230	158	132	2,098
		37,811	7,257	6,126	29,719
September ... 7	6,6	2,020	32	27	1,993
9	6,9	2,230	158	132	2,098
19	7,0	2,300	200	167	2,133
20	7,7	3,113	687	574	2,539
21	6.8	2,160	116	97	2,063
22	7 1	2,415	270	224	2,191
23	7.4	2,760	476	397	2,363
		16,998	1,939	1,618	15,380

APPENDIX A. E. XXIV.

STATEMENT showing effect of impounding at Kannambadi on Madras supplies during the actual periods of impounding.

Period of impounding	Number of days	Total flow Aganda Cauvery without impounding for the period	Reduced by impounding during the period	Actually surplused during the period column 4 Madras Project Working Tables	Resulting flow at Aganda Cauvery after impounding column 3—column 4	Irrigation supply under the award for the period	Increment due to floods during the period over irrigation supply column (7)	Supply required by Metur Project	Increment over standard supply column (9)	Total impounded for the year
1	2	3	4	5	6	7	8	9	10	11
1899—1900.										
June 19—24	6	20,745	8,565	11,880	12,180	11,796	384	2,148	9,648	28,656
July 3—15	13	37,811	12,075	18,052	25,736	25,558	178	20,800	4,936	
September 7, 9, 19—23.	7	16,998	3,236	7,054	13,762	13,762	...	6,686	7,076	
1904—1905.										
June 16, 17, 23—30 ...	10	27,330	7,364	27,237	19,966	19,660	306	3,580	16,386	70,470
July 1—29	29	104,654	40,087	41,948	64,567	57,014	7,562	46,400	18,167	
August 7—19	13	36,487	10,929	9,843	25,558	25,558	...	20,800	4,758	
September 18 ...	1	2,300	334	...	1,966	1,966	...	1,098	868	
1905—1906.										
June 25	1	2,020	54	...	1,966	1,966	54	358	1,608	25,909
July 2—7, 12—14, 23—31.	23	67,890	21,085	31,451	46,805	45,218	1,587	36,800	10,005	
August 1—5										
1908—1909.										
July 6—12, 18, 19, 21—31.	20	62,098	22,230	47,205	39,868	39,320	548	32,000	6,868	56,716
August 1—18 ...	18	61,994	24,387	39,425	37,607	35,388	2,219	28,800	6,588	

APPENDIX A.E. XXV.

Ma. 20, Jamabandi extracts, considered in detail for the four bad years on the evidence regarding crop outturn.

1889 attributes bad outturn to low freshes in the river June-middle August. This is not altogether borne out by the gauge records—Volume III, Metur Project; there was considerable surplusing in June and July, and it is only from these surpluses that Mysore can be permitted to impound. The low supplies in August would not have been affected by impounding as none would have occurred. It is also to be noticed that much of the damage was due to excessive late rains in the delta.

1904-05 attributes decline in area compared to that of the preceding year to unfavourable character of the season owing to want of rain and insufficient supply of freshes in the river in the latter part of the season. The statement as to the comparative area may be true as applied to the whole district, but is not true as applied to the Cauvery irrigation; the figures taken from the diagram Ma. 9 amounting to 1,000,000 in 1904 as against 993,000 in 1903, and it may be noted that in 1903 the supply was larger than in 1904. The insufficient freshes in latter part of season would not have been at all affected by impounding as none would have been permissible.

1905-06—Distinctive features of the year, late commencement of wet cultivation due to deficiency in July and damage from excessive rain later in the season.

The deficiency alluded to in July can only refer to rainfall not to river supplies, as records show very good river supplies in July, and very considerable surplusing; as the Mysore impounding would only have held back part of this surplus supply, the effect on season could not possibly have been felt.

1908-09—Decrease in wet cultivation attributed to freshes in the river being a month late. But records show an increase in area of 1·1 per cent above average for twenty years; while river gauges show that good freshes did not commence till 6th July; the July and August supplies were very large, and large surplusing took place in both months: as the Mysore impounding would only have held back part of that surplus, it could not possibly have affected the season outturn.

Arbitrator's Award on Term of Reference 3 (a).

" What principles and rules for regulation of the discharges in connection with the Kannambadi Reservoir can best be formulated which will ensure to Madras full protection of their prescriptive rights ? "

By consent of parties, *vide* Arbitration Proceedings of March 31st and April 11th, only the " principles " or, as understood by the parties, the " systems " for regulation of the discharges at Kannambadi Reservoir have been discussed at this stage of the case. The "rules" have been left for consideration along with the term of reference 3 (*b*) and the fourth term of reference, all of which will be dealt with together in the final stage of the proceedings.

Four systems have been discussed. They are referred as (1) the Madras system, (2) the Mysore system, (3) the proportionate system and (4) the modified Madras system.

Systems (1) and (2) are those propounded by Madras and Mysore, respectively.

For the origin of the so-called "proportionate system" we must go back to the Arbitration proceedings of the 6th August 1913, when the Assessor and I proposed the following term of reference :—

" What portion of this volume (*i.e.*, the volume of water measured at the Upper Anicut) may reasonably be assumed to be due to that portion of the whole catchment area which would be intercepted by the Kannambadi Dam ? "

This proposed term of reference was struck out after discussion. In its place we called on the parties to furnish computations which would enable us to form an opinion on the following point :—

" What proportion of the volume of water measured at the Upper Anicut may reasonably be assumed to be due to that portion of the whole catchment area which would be intercepted by the Kannambadi Reservoir ? "

The fourth or modified Madras system is a modification of the Madras system proposed by Mysore as an alternative in the event of their own system not being adopted.

Full details of these systems are to be found in the exhibits. The outlines of the systems 1, 2, 3 are thus given in Ma. 24 (3) :—

" (1) The Madras system proposes the simultaneous measurement of the inflow to the reservoir and of the flow of the Kabbini and that Mysore should be allowed to impound whenever this continuous flow exceeds the ' limit flow ' at the Upper Anicut *plus* percentages to cover risk of loss in transmission.

" (2) The Mysore system involves forecasting from the quantity of measured inflow into the reservoir what the flow at the Upper Anicut is likely to be by means of proportion factors fixed for the south-west and north-east monsoons and impounding any available surplus over this, making allowance for loss in transmission. Combined with this is provision for passing compensation water from the Mysore reservoir to make up for deficiencies in the supplies received by Madras on days when the proportion factor failed to give the supplies due.

" (3) The third system has some of the characteristics of both the above and is simpler and more easily applied than either.

" This consists of fixing for the south-west and north-east monsoons the proportions which the measured daily inflow into the reservoir will bear to the probable corresponding flow at the Upper Anicut and multiplying these proportion factors by the limit flow allowed to Madras. Mysore is under this system to be allowed to impound all water coming into the reservoir in excess of that due to the resulting figure."

Fourth or modified system.—The modification suggested by Mysore in the Madras system consists in the substitution of proportion factors of ·75 and ·33 for the south-west and north-east monsoons, respectively, in lieu of the factors 1·25 and 1 proposed by Madras for the two monsoons.

The essential principle of any system eventually adopted must be that it must be such as to conserve unimpaired the prescriptive rights of Madras. Another consideration to be borne in mind in the examination of any system is that no available surplus capable of utilization should be allowed to run to waste. "The gifts of nature are for the benefit of mankind, and no aggregation of men can assert and exercise such rights and ownership of them as will deprive others having equal rights, and means of enjoying them, of such enjoyment." Farnham on Waters, page 29.

The Assessor, in his very full and thorough examination of the systems under discussion, has given his reasons for not accepting without modification any of the four systems. The system which has recommended itself to him as the result of his examination may be described as a combination of the Mysore system with the proportionate system with certain material modifications.

With his reasons and conclusions I fully concur.

Without going into detail, the fundamental defect of the Madras system, in my opinion, is its unfairness to Mysore in making the Mysore catchment area solely responsible for the maintenance of the 6·5 feet gauge at the Cauvery Dam. It has been shown conclusively by the Assessor that at high stages of river flow (with which alone Madras need be concerned) the Bhavani and other Madras tributaries of the Cauvery contribute an appreciable percentage of the flow at the Cauvery Dam. The Madras system appears to have been conceived with the sole idea of conserving Madras interests without regard to the possibility that the conservation of those interests might be compatible with the successful working of the Kannambadi Reservoir. It is true that in Ma. 26 (20) Madras conceded the right of Mysore to impound provided that the prescriptive rights of Madras under the Award can be fully protected under the system of measurement and regulation proposed.

The Mysore system might be acceptable if the whole irrigation from the Cauvery were under one administration or under two administrations working in complete harmony. The essential condition of the success of the Mysore system is the harmonious co-operation of both Governments. In the present condition of affairs when we find the interests of the two Governments conflicting and their attitude on the question before us more or less irreconcilable, I think that the complex system proposed by Mysore is calculated to engender undesirable friction between the two Governments and for that if for no other reason, should not be sanctioned. Further, the Mysore system overlooks at times the paramount importance of the conservation of the Madras rights. A re-adjustment of a factor or the adoption of a system which might possibly result in an increased benefit to Mysore, but which would have the effect of inflicting a loss however small on the existing rights of Madras, cannot be permitted. As to the Madras objection that the Mysore system would interfere with possible future development of their irrigation from the Cauvery or its tributaries, I need only say that in this Arbitration I am dealing with the state of things as they are at present and as they would be affected by the Mysore project. I am not called upon to express any opinion on the respective rights of parties which future possible developments may give rise to.

As to the proportionate system, the materials available have enabled the Assessor to arrive at an approximate figure representing the proportion due to the Kannambadi catchment at the Cauvery Dam at gauges of 6·5 feet and upwards.

It is recognised that any proportionate figure fixed by the Award can only be a tentative one inasmuch as the actuals on which computations have been made, are, in some instances, inaccurate and in others not sufficient to afford a sure basis of calculation and also as it would not be safe to base on purely theoretical assumptions a final Award on a point of vital importance.

In view of this fact that any proportion figure fixed by the Award can only be tentative, the volume of discussion on the question of the proportion figure is much greater than its importance warrants.

I am satisfied that the figure which the Assessor has estimated as representing the proportion due to the Kannambadi catchment at the Cauvery Dam is as close an approximation to exactitude as the figures before us admit of. In fixing 62·5 as the proportion he has in fact raised slightly the figure arrived at by calculation.

Before dealing with the Award, there are certain matters which require special mention.

Mysore would apparently interpret the Award under term of reference 2 (*b*) as fixing 6·5 feet gauge as the limit of Madras supplies for the future. I may here place on record that in fixing the 6·5 feet gauge I had in mind only the requirements of Madras existing prescriptive rights. I did not touch on or consider the flood increments, which, in the natural course of things, Madras has received in the past and a proportion of which Madras must continue to receive in the future by whatever system a reservoir at Kannambadi should be regulated.

A further discussion on the requirements of the Coleroon irrigation does not come within the term of reference under consideration; but, as it is desirable to clear up any possible misconception as to the Award under term of reference 2 (*b*), I may say here that the fresh figures and reasons adduced by the Assessor in dealing with this question fully confirm the view taken by him in his Examination of Evidence under term of reference 2 (*b*). It is demonstrated by the evidence that in the past no specific supply was passed down for the Coleroon irrigation except that over the Calingulah and it is abundantly clear that there is an ample supply of water which Madras can utilise by effectively controlling the river flow instead of allowing the greater part of it to run waste to the sea.

The standard by which the Assessor estimates the loss to Madras under the system under examination appears to me to be a reasonable one. Madras could not expect a 6·5 feet gauge throughout the irrigation season. The supplies as stated in the Metur Project as the supplies necessary for actual requirements during particular periods appear to afford a reasonable standard by which loss to Madras could be estimated.

With reference to paragraph 120-A of the Assessor's Examination of Evidence and Appendix A.E. XXV, it appears to me that in bad years the poorness of crop outturn immediately attributable to a bad season or short supplies in a bad season, will not in any way be enhanced by impounding from surpluses which would otherwise run to waste.

The table in paragraph 122 of the Assessor's Examination of the Evidence makes clear the important fact that, even in the worst years for which the records have been examined under whichever system of impounding at Kannambadi, there would still be a large surplus wasted into the sea.

The principles of the system proposed by the Assessor appear in my opinion to satisfy fully the first essential that the Madras prescriptive rights shall be fully safeguarded; while, on the other hand, it gives to Mysore the opportunity of utilising to as large an extent as is practicable under the present natural conditions a fair proportion of the surplus waters of the Cauvery.

My Award on that part of term of reference 3 (*a*) which is under consideration at this stage of the proceedings may be set out in the words of the Assessor as follows:—

"A. Daily gauges at the Cauvery Dam and details of flow and gauges at Kannambadi, such as will clearly show the working of the reservoir both as to inflow and outflow, should be telegraphed daily by each party respectively to the other party.

"B. Standard tables should be worked out for all stages of the Kannambadi flow above the limits, for the south-west monsoon of $\frac{62{\cdot}5 \times 1966}{100}$ = 1,230 millions cubic feet (approximately) of which 80 per cent is estimated to reach the Cauvery Dam, and for the north-east monsoon of $\frac{30 \times 1966}{100}$ = 590 millions cubic feet (approximately) of which 83 per cent is estimated to reach the Cauvery Dam. These tables should be worked out on identical lines as those given in Appendix XXI and Appendix XXII, the essential principles being that impounding at Kannambadi under standard table I will be regulated so as to maintain the limit flow at the Cauvery Dam as is shown in the sample Appendix XXI, while, under standard table II, regulation of impounding at Kannambadi will be restricted as is shown in the sample Appendix XXII.

"In the south-west monsoon no impounding should be permitted until the flow at Kannambadi exceeded $\frac{62{\cdot}5 \times 1966}{100}$ = 1,230 millions cubic feet (approximately). And no impounding in the north-east monsoon should be permitted until the flow at Kannambadi exceeded $\frac{30 \times 1966}{100}$ = 590 millions cubic feet (approximately), these limits being the computed contributions inclusive of losses *en route* from the Kannambadi catchment to the limit flow at the Cauvery Dam under award 2 (*b*) for each monsoon.

"Impounding in the south-west monsoon should be allowed to commence under table I if, at any time during the preceding four days the Cauvery Dam gauge had exceeded 6·0 feet, while, if at any time during the preceding four days, it had not exceeded 6·0 feet impounding should be restricted to table II until the Kannambadi inflow reached the equivalent value in cubic feet per second corresponding to 1,330 millions cubic feet in 24 hours when it should be continued under table II for a further 12 hours, and should thereafter continue under table I.

"It is to be understood that the figures herein given of limit flow at Kannambadi are based on the tentative factors now proposed and are to be subject to final adjustment when necessary data are available."

21*st April* 1914.

H. D. GRIFFIN,
Arbitrator.

PART IV.

Assessor's Examination of the Evidence on Term of Reference 3 (a) regarding rules which were not considered in Part III and Term of Reference 3 (b) and 4.

The issues still to be decided and now under consideration are:—

The rules under issue 3 (*a*),

Whether they should not be tentative at first and for how long, under 3 (*b*); and

Whether the working of the Mysore reservoir will necessarily prevent the passing on to Madras of the quantity of water due to Madras, under issue 4.

The special evidence and arguments put in by either party on these various issues are contained in Ma. 28, 29, 32, 35, 36, 37 and 38 and My. 28, 29, 32, 33, 34, 35 and 36.

Rules under issue 3 (*a*).

2. With regard to rules under issue 3 (*a*), at a meeting before the Assessor on 7th May, the suggestions of both parties under this head were discussed and it was found possible to deal with the greater part of the rules as non-contentious.

There is no need for me to discuss here this non-contentious matter: the outcome of the discussion is recorded in the supplement attached to this part of my examination—Rules I to XXII.

3. The contentious matter connected with the rules as suggested by either party is as follows:—

(1) The Madras proposal that the controlling officer and staff for the regulation of the reservoir shall be independent of both parties and appointed by the Government of India;

(2) The suggestion of Mysore that they should be given the advantage of impounding, irrespective of the limits of the Award, on occasions when rainfall in the delta may reduce the demand on the Cauvery system; and

(3) The question as to whether any allowance is to be made in the reservoir issues under the Award, to adjust quantities of water required for any extension, or change in character, of irrigation in Mysore channels taking off either above or below the reservoir.

4. With regard to (1), the Madras argument may be summarised as, that, in a matter of such importance to both parties, it is desirable to have independent control which would ensure strict observance of the Award in working the reservoir; and Mysore object to it on the ground that they are quite prepared to guarantee strict observance of the Award by their own officers, that they object to the interference with the jurisdiction of their own work, and that the proposal of Madras carries with it implied suspicion.

5. There is no reason to suppose that the Mysore Durbar are not fully capable of exercising the control necessary to ensure the strict compliance on the part of their staff with the rules which are to be drawn up to ensure the principles laid down under the Awards 2 (*b*) and 3 (*a*) being made effective; while the various automatic checks, which it is proposed to introduce for the convenience of regulation, are such as may reasonably be expected to ensure that the rules will be strictly observed. On these grounds, if the Arbitrator considers that this matter of staff comes within the scope of his jurisdiction in this case, I do not think that there is justification for introducing the independent and outside staff to which Mysore object, it being always understood that full responsibility for the control of regulation of the reservoir in accordance with the principles of the Award rests with them.

6. (2) The suggestion of Mysore that they should be given the advantage of impounding in excess of the Award limits on occasions of rainfall in the delta

appears to me to be impracticable. I do not see how prescriptive right to the waters of the Cauvery, which is the basis of the Award, can be affected by rainfall in the delta some 250 miles distant from the Kannambadi Reservoir. It is undoubted that, if the reservoir were in Madras territory, full advantage would be taken of the opportunity to hold back supplies whenever not required in the delta; but to endeavour to give Mysore this advantage would, I consider, be fruitful of very frequent friction between the two Governments which it is on all grounds desirable to avoid. I therefore cannot advise the Arbitrator that this request of Mysore should be accepted as an item of the present arbitration.

7. (3) With regard to the Madras demand that any extensions of irrigation on existing channels in Mysore should be taken into account in adjusting the supplies due to Madras under the Award, it may be explained that Madras do not wish to restrict what may be regarded as natural development of existing canals in Mysore, to which prescriptive right to full development already attaches, but only to secure that the quantities of water due to Madras under the Award shall not hereafter be diminished by extension of the Mysore channels which would not have been possible if the reservoir were not constructed. In this contention I consider Madras are justified.

7-A. It is also to be noted that Madras make no objection to the Mysore proposal for extension of irrigation on existing channels above the reservoir to replace the existing irrigation in the area which will be submerged by the reservoir. This area was given in the project as 7,224 acres, which, however, was subsequently revised to include lands on which wet rates were charged though classed in settlement records as dry. This revised figure amounted to 9,274 acres as detailed in paragraph 4, My. 35, and Mysore also claim to be allowed an increase of 33 per cent in the area for assumed improvement in duty. In absence of direct evidence that this amount of increase would have been possible in the tract submerged, I think this allowance is too high. It is very significant in this connection that even the restrictions, which in past years have been put on irrigation supplies in order to secure the necessary power supply at Sivasamudram, have resulted in diminution of irrigation to the extent of about 500 acres annually, showing that existing irrigation was very close to the margin of full development possible with existing supplies. An increase of 10 per cent, however, may be accepted as reasonable on this account, and I would suggest for the consideration of the Arbitrator that an area of 10,200 acres in round figures is a fair one to allow in lieu of the existing irrigation in the submerged area.

8. With regard to the Madras contention as to other extensions, it will be remembered that Mysore made exactly similar claims regarding development of irrigation on similar Madras channels which I dealt with in paragraphs 122 to 132 of my Examination of the Evidence, Part II. The same question as to the status of these channels under the Agreement of 1892 was dealt with in Part II, paragraph 113, when dealing with the hot weather supply. I consider that this contention of Madras will be met by a rule to the effect that any extension of such channels which is made in a given tract of country, not hitherto commanded by existing channels, or any extension whether above or below the reservoir which entailed any alteration to existing anicuts or headworks, whereby larger quantities of water can be taken into those channels than have been utilized in the past, then the quantities of water necessary for such extension should be deducted from the quantities to be impounded under the standard tables in the case of channels above the reservoir, and be added to the quantities to be passed on to Madras in the case of channels below the reservoir.

On the other hand, any minor extensions or improvements to existing systems which do not command new tracts, and which do not entail additional or enlarged head sluices, or the extraction of larger quantities of water from the river, than have been used in the past, and on which new irrigation may therefore be regarded only as a natural development of existing systems, should not be taken into account.

9. Whether or not such extension should or should not count as requiring adjustment of the quantity of water to be impounded at, or passed on from, Kannambadi under the award must, in case of dispute between the parties, be referred for final decision of the Government of India. The rules I suggested in accord with

my recommendations on this head are incorporated with the rules in the supplement—Rules XXIII to XXV.

10. There is one other point on which there has been a certain amount of dispute between the two parties during this discussion, which it is desirable that I should note on for the consideration of the Arbitrator, and that is the extent to which information regarding the reservoir project or any such extensions as are referred to in the preceding paragraphs 7 – 9 should be intimated by Mysore to Madras. The Agreement of 1892 lays down that full information regarding any such proposals of extension of irrigation as require reference to Madras should be furnished, and this I consider must be taken to apply to full information as is ordinarily submitted with such projects when they are submitted for consideration and sanction. In the case of the reservoir this demand comprises full structural details sufficient to illustrate the technical stability and practical working of the scheme; with regard to the channels it would require plans showing the general alignment and the limits of the areas commanded by the channels within which irrigation is contemplated, and the areas of irrigation proposed. Madras have stated that their desire in asking that such information should be furnished to them in the present case, is not that they may interfere in any way with the proposals of Mysore as to internal working, but only that they may be informed of the scope of the project within the terms of the 1892 Agreement, and I think there can be no doubt as to the obligation of Mysore, under that Agreement, to furnish the information which I have herein defined.

Issue 3 (b).

11. Under issue 3 (*b*) the question to be dealt with is as to how far the rules now proposed should be tentative; with regard to the rules, proposals which have been accepted by both parties are made in the preamble to the statement attached hereto. With regard to the re-adjustment of the tentative proportions laid down in the award under 3 (*a*), both parties are also in agreement that the question shall be taken up after a period of four flood seasons, after which period, say, about November 1917, the additional data to be collected under the rules will be reviewed by an officer appointed for the purpose by the Government of India.

Issue 4.

12. Ma. 28 is an important referendum to the Arbitrator as to whether the success or failure of the Mysore scheme, to absolutely secure the irrigation and power supplies as designed, is to be considered as material to the decision under issue (4).

13. On the 29th April the Arbitrator ruled that he was prepared to consider any arguments which Madras wished to put forward based on their examination of the project in that aspect.

14. In Ma. 29 the arguments of Madras on this point are developed, and it will be convenient to consider them under the two distinct heads which are defined in paragraph (4) of My. 29, *viz.*, the effect of possible serious failure or partial failure of the Mysore scheme (*a*) on Mysore and (*b*) on Madras. Their arguments under (*a*) are set forth in paragraphs 7, 15, 16 and 17 and those under (*b*) in paragraphs 8 to 11.

It is, however, very important to note the essential spirit in which all these arguments are advanced by Madras as defined in paragraph (6) as follows:—

"If the conditions of working, as examined on the best available data in the form of working tables for a considerable series of years, show that, under such regulation as will give to Madras the supplies to which they are entitled, the Mysore reservoir can successfully and without serious failure supply the water to the new irrigation in Mysore which is required under the proposals constituting the project, the scheme would appear feasible and, so far as reasonable forecast can determine, would have assurance of being successfully operated. *To such a project Madras has no opposition to offer.* If, however, the working tables show that there is *liability to occasional disastrous failure, and frequent minor failures occur, unless the supplies to which Madras is entitled are intercepted*, then it is submitted that the Madras interests will be exposed to grave danger." (The italics are mine.)

From which it is clear that Madras has no desire beyond the protection of her own interests to oppose any reasonably feasible scheme, and has no opposition to offer to any project which has reasonable prospects of success consistent with the due safeguarding of Madras interests.

15. It will be evident that a reasonably safe forecast of the prospects of the success or failure of the scheme can be arrived at by a consideration of the results of the working tables, which have been prepared by either party for the purpose, and that the effect on Mysore can therefore be determined, within certain limits, as a matter of concrete proof. The effect on Madras, however, of the scheme considered in this aspect is obviously a matter of pure conjecture.

16. I do not refer here, of course, to the question of the safeguarding of the Madras rights under the Award which my Examination of the Evidence, Part III, has shown can be fully secured, and it is to be understood that the working tables show results to Mysore after the full supply to Madras of the water due to her under the awards already delivered in this arbitration.

17. As advanced by Madras, the conjecture as to the possible effect on Madras of partial failure of the reservoir in Mysore is embodied in two suggestions:—

(1) That, especially during periods of low supplies, such as have occurred in the past, the temptation to withhold from Madras her full dues under the award will be too strong for a venal subordinate staff to resist; and

(2) Without in any sense impugning their good faith, that the Mysore Government will be unable to check such delinquencies on the part of their staff, or to ensure efficient control of the regulation at the reservoir, and the strict observance of their liabilities under the Award.

18. In My. 28 (11)—(13) the Mysore Durbar strongly deprecate these suggestions and in paragraph 17 emphatically record their resolve to perfect the gauging and regulating operations so that the supply due to Madras may be correctly passed on from day to day and the obligations of Mysore scrupulously fulfilled.

19. In their rejoinder, Ma. 32, the Madras Government refrain from any further argument on this head and leave the matter for the consideration of the Arbitrator.

20. I submit for the consideration of the Arbitrator that the attitude with regard to their obligations under the Award, which Mysore have so clearly and emphatically defined, is the only attitude which it is possible to attribute to either of the parties to this arbitration in view of their relative high dignity and their mutual grave responsibilities.

21. The Madras arguments under the other head, *viz.*, the effect of possible failure of the scheme on Mysore, may be summarised as, that a scheme which is not fully successful and which thereby has in it inherent elements of risk to the Madras prescriptive rights, ought not to be allowed. The risks to Madras have already been dealt with and once her prescriptive rights are fully secured, as they will be if the principles under the Award 3 (*a*) are adhered to, I can find nothing in the 1892 Agreement which would justify Madras in withholding consent on any such grounds as indifferent results to Mysore of any project put forward by Mysore under that Agreement. It is pertinent to quote here for easy reference the exact wording of the Agreement which appears to me to wholly govern this matter of consent. "The Madras Government *shall be bound not to refuse such consent except for the protection of prescriptive right already acquired and actually existing* . . . ." (The italics are mine.)

22. This clause of the Agreement is the basis of the opinion which, more than once during the proceedings, I expressed informally, as is referred to in Ma. 28 (4), and this opinion appears to me to be that of the Government of India as indicated in the letter to which Madras refer in Ma. 29 (17) wherein the essential objection to the scheme as projected is stated to be, that it might seriouly interfere with the existing irrigation of the Madras cultivators; while at the same time advice is given to the Durbar that, if the capacity of the reservoir were increased, it would be sufficient for the requirements contemplated by the Durbar; and the inference is unavoidable that the Government of India considered that, *if such modification were made*, the essential objection to the scheme previouly defined would be removed.

23. It is to be remembered that, at the time that letter was issued and that advice given, the prescriptive rights of Madras under the 1892 Agreement had not been defined as they now have been, and it was therefore impossible at that time to so accurately estimate the status of the Mysore scheme, whether as affecting Madras or as affecting Mysore, as is now possible. But it would obviously be altogether contrary to the spirit of the Government of India letter to deny to Mysore the right to modify their project in any way that may appear to be desirable, now that the prescriptive rights of Madras under the 1892 Agreement have been determined.

24. Moreover, this interpretation of the Government of India letter appears to me to be in complete harmony with the essential spirit of the Madras objection, as defined by themselves, to which I have referred in paragraph 14; and finally I submit for the consideration of the Arbitrator that it is in complete accord with the terms of the 1892 Agreement.

25. In replying to the Madras arguments now under consideration as to the effect of the project on Mysore, the Mysore Durbar have in My. 28 (16) expressed their readiness to modify their project by increasing the capacity of the reservoir if it is found to be desirable or necessary to do so.

25-A. Hence, in examining the results of the working tables, the possible advisability of modifying the project must be kept prominently in view, in conformity alike with the recorded advice of the Government of India, with the avowed spirit of the Madras objection, with their recorded willingness to consent to a scheme reasonably free from risk of failure, and with the recorded willingness of the Mysore Durbar to modify their scheme if it be found necessary to do so, in order to free it from such risk of failure.

26. In considering the results of the working tables as put in by either party, and which have been accepted after comparison as materially correct, it is to be remembered that they are based on the Kannambadi computed discharges which, though not absolutely reliable, have been accepted for the purpose of the examination as the best available.

27. The areas of irrigation adopted are those of the Mysore project: the duties are considered quite reasonable. The power supply has been taken as 1,000 cusecs delivered at Sivasamudram although the award for the hot weather months which are those chiefly affected is 900 cusecs only. This power supply of 1,000 cusecs at Sivasamudram has been secured as a first call on the storage at the expense, when necessary, of the irrigation supplies. Throughout the working tables the full quantities of water due to Madras under the award have been secured before any impounding is allowed. Hence the tables may be taken as giving a reasonably accurate forecast of the probable working of the reservoir for irrigation supplies after fully securing the Madras rights and the supplies necessary for power.

28. In order to ensure the supply necessary for power as a first charge on the storage, it was necessary to adopt some scale for limiting the issues for irrigation supplies so that they could not encroach on the reserve for power; the scale put forward by Mysore for this purpose was agreed to by Madras as reasonable, whereby irrigation supplies in the working tables are varied according to the balance of water in the reservoir at the end of September or October. I quote this scale here for ready reference, and in column (3) add the percentage of deficiencies on those specified dates below full irrigation requirements :—

Class.	Supply	Percentage less.
	at end of October.	
A	33,500	Full (supply).
B	31,500	6 per cent.
C	29,500	12 ,,
D	27,500	18 ,,
E	25,500	24 ,,
F	23,500	30 ,,
	at end of September.	
G	26,500	31 per cent on 38,400 required for full supply.
H	24,500	36 ,,
K	20,000	48 ,,

It is to be understood that in all cases issues up to these dates have been calculated at the full supply required by the project areas and duties.

29. In considering the results of the working tables, the years have been classified under the letters given in the scale according as to which scale had to be adopted for regulation of irrigation supplies on the critical dates. This classification is given in Ma. 35 (32) and is summarised by Madras as follows:—

	YEARS.
Full success	6
Minor failure	4
Medium failure	1
Major failure	2
Total ...	13

and in Ma. 35 (37) Madras urge that this displays the project as insecure and unpromising, and in paragraph 34 "undoubted failure", while in paragraph 37 they ask that on these grounds the finding on the fourth issue should uphold and confirm their original refusal to consent to the project. Mysore, on the other hand, after discussing the results in My. 33, point out in paragraph 9 that no reservoirs are secure from occasional partial failure, and reiterate their readiness to modify the project if necessary, while in paragraph 14 they claim that the project be accepted in every way as having been prepared on a sound basis. Thus there are two diametrically opposite deductions and recommendations put forward by either party which are both based on identical data, and it is desirable that this matter should be further examined.

30. Taking now the four years which Madras claim to show as minor failures, these all come under classifications B and C showing that at the end of October supplies in the reservoir were within 6 per cent to 12 per cent of full requirements, while even in the "medium failure" year under F the deficiencies were only 30 per cent of full requirements. In Ma. 37 (7)—(8) these deficiencies are given as ranging from 5 per cent to 15 per cent on the supply for the whole year and from 11 per cent to 33 per cent on the supply from 1st November. It may be said at once that shortages such as these are not at all uncommon in all canal systems and storage works in India. If such works were all designed to utilize only the minimum supply available in the river or stream on which they depend, it is quite safe to say that the areas annually irrigated from canal works in India would be certainly not more than from a third to a half of what they now are; and the monetary loss to the country in such case could be reckoned only in crores per annum. It is scarcely necessary for me to refer back to the remissions of revenue in the Cauvery Delta, already considered in these proceedings, which are partly due to occasional shortages of supply below the full requirements, to show that, in their own irrigation systems, Madras do not restrict their areas to their minimum available supply, and that they do not secure a full crop area or outturn every year: and the same is generally true everywhere. It is therefore quite pertinent to this particular argument of Madras regarding these years to compare these shortages of supply, from the end of October onwards, which, in the case of the Mysore project, vary from 6 per cent to 30 per cent with the shortages of supply evidenced in the Cauvery Delta for these months as below the normal standard requirements—*vide* A. E. XV where the shortages range as high as from 60 per cent to 90 per cent in several cases.

31. To have to work with 70 per cent of full supply, as is the case even under class F, is a very common occurrence, indeed, within the experience of all canal officers; and as a canal officer I should classify all these years represented by Madras as minor and medium failures as indicating from very good to reasonably successful operation of the reservoir.

32. In the two worst years 1899-1900 and 1908-09, as exhibited by the working tables, the total deficiencies in irrigation supplies as compared with full supply required are, as shown in table Ma. 37 (3), 42 per cent and 35 per cent, but even these do not necessarily mean anything like serious failure.

33. As a pertinent comparison, take, for example, the figures given in column 5 of Appendix A. E. VI which are the Madras Government's own estimates of the

supplies actually enjoyed in the past, and necessary for her delta irrigation, where it will be seen that the total supplies of the two worst years were 157,199 and 176,636 only as compared with the year of maximum supply 389,721, the percentage of deficiencies being 59 per cent and 54 per cent, respectively, and both being greater than the worst year of the Mysore project. Can it be accepted for one moment that these and other similar deficiencies in the Cauvery supplies below normal or maximum requirements as displayed by those figures, are satisfactory evidence that Madras has been wrong to develop the delta irrigation to the extent she has done, and that the expenditure on that system has been ill-advised or unjustified?

34. The probability is that, even in such bad years as these, the Mysore reservoir, as at present projected, would mature from two-thirds to three-fourths of the full area; while it may be admitted that in all years the area and outturn will be liable to fluctuation due to natural and seasonal causes just as is the case in the delta irrigation. The deficiencies shown in Ma. 37 (3), however, appear to me to indicate that it would improve the project considerably, if it were modified to secure the extra 4,000 to 5,000 millions cubic feet, which Mysore state is feasible, by a readjustment of their flood escape levels; such a modification together with the slight margin they have in the hot weather supply taken in the working tables as 1,000 cusecs as against 900 cusecs required by the Award, would more than cover all the deficiencies except those of 1899, 1905 and 1908, which, however, would probably be further reduced by the larger opening balances thereby made available, so that the slightly larger reservoir might reasonably be expected to secure the full area or very nearly the full area even in bad years. This modification I should advise the Durbar to consider—advice (*vide* paragraph 25-A) which is in general accord with that previously tendered to the Durbar in respect to this scheme by the Government of India, and is also calculated to modify the Madras objections to the present scheme and render it acceptable to them, while the Durbar have already signified their willingness to so modify the project, should it appear desirable to do so.

35. Beyond this, I do not think it is open to the Arbitration Committee to further investigate the project as it affects Mysore. The Mysore Durbar have unquestionably the right to determine whether any particular scheme is a sound one from their own point of view; while, even if the present scheme is not believed by them to be a complete financial success, there is ample precedent in India and elsewhere for schemes of general public utility deliberately undertaken in full knowledge of the fact that they are not directly remunerative; the whole range of famine and protective works in India come under this category. As it affects Madras, my opinion is that the reservoir can be operated, whether as designed or with slight modification should Mysore decide that this is desirable, in such a way as will fully secure the prescriptive rights of Madras and with no risk whatever to, or any infringement of, her vested interests. This conclusion is in general accord with the representations made by Mysore as to the results of the working tables and I therefore need not discuss their arguments on this matter in further detail.

36. I submit for consideration of the Arbitrator that, after fully safeguarding the Madras prescriptive rights under the Award, both in the monsoon and hot weather seasons, and also after fully securing the necessary supply for power, the Mysore reservoir as designed stands on a reasonably sound footing considered as an irrigation storage work, and that therefore, under the terms of the 1892 Agreement, consent to its construction should be awarded under issue 4.

M. NETHERSOLE,
Assessor.

12*th May* 1914.

Supplement to Part IV.

Rules of Regulation.

(i) PREAMBLE.

The carrying out of the following rules of regulation shall, in so far as they relate to the regulation of Kannambadi Reservoir, be the duty of a controlling officer and of a subordinate staff working under his orders.

2. The only discretion to be exercised by the controlling officer in operating the Rules of Regulation shall be as to the means by which the water to be passed from the reservoir to the river shall be passed and such discretion shall be exercised in general accordance with the instructions of the Mysore Government.

3. The rules, with the exception of Nos. I to IV inclusive, shall be subject to amendment as may be found desirable, subject to the conditions below: —

(*a*) The rules may be altered tentatively for one or two years by agreement of both parties or, in default of agreement, under the decision of the Government of India, after hearing both parties.

(*b*) At the end of the tentative period the amended rules may be confirmed either by the consent of both parties or, if only one party desires confirmation, under the orders of the Government of India, after hearing both parties.

(*c*) Subject to conditions (*a*) and (*b*) above, amendment of any rule shall not be a bar to further amendment or reversion to the original rules by consent of both parties or, if new facts are adduced, under the orders of the Government of India, after hearing both parties.

4. The tentative proportion factors in Rules II and III and the tentative percentage losses in transmission from Kannambadi to the Cauvery Dam of 20 per cent in the south-west monsoon and 17 per cent in the north-east monsoon shall be in force for four years from now and shall be reviewed by the Government of India at the end of that period after hearing both parties and, if found practicable by that Government, final factors and percentages shall then be fixed. The factors and percentages finally fixed by the Government of India shall not be subject to revision.

5. The curves of discharge of all gauging places in Mysore State and of the Cauvery Dam should be verified at intervals of two or three years.

6. All formulæ and co-efficients in such formulæ of discharge referred to in the rules should be verified at intervals of two or three years.

7. If the verification of curves of discharge or formulæ referred to in clauses 5 and 6 above show that revision of the curves or formulæ or co-efficients in the formulæ is necessary, such revision shall be made subject to the conditions specified in clause 3 above.

8. All quantities and readings of gauges to be telegraphed in accordance with the rules, shall be expressed in words.

(ii) RULES OF REGULATION.

I. The south-west monsoon shall, for the purpose of these rules, be considered to extend from the 1st June to the 30th September, both dates inclusive, and the north-east monsoon from the 1st October to the 31st January, both dates inclusive.

Impounding.

II. Impounding in the Kannambadi Reservoir during the south-west monsoon shall be regulated in accordance with standard tables I-(*a*) and II in the following manner —

(i) Impounding under standard table I-(*a*) shall commence as soon as the flow at Kannambadi exceeds (·625 × 22,750 cusecs) = 14,219 cusecs, provided that the flow over the Cauvery Dam *plus* any discharge through the vents of the Upper Anicut had exceeded 18,850 cusecs at any time during the preceding four days.

(ii) If the discharge of 18,850 cusecs referred to in clause (i) of this rule had not been exceeded at any time during the preceeding four days, then impounding shall commence under standard table II.

(iii) If, during the period of operation of standard table I-(*a*), the discharge of 18,850 cusecs referred to in clause (i) of this rule, had not been exceeded at any time during the preceding four days, then impounding shall proceed under standard table II.

(iv) If, during the period of operation of standard table II, as provided for in clauses (ii) and (iii) of this rule, the flow at Kannambadi reaches 15,277 cusecs, then twelve hours after the inflow had reached this stage impounding shall proceed under standard table I-(*a*), provided that the discharge of 18,850 cusecs referred to in clause (i) of this rule had been exceeded at any time during the preceding four days.

III. Impounding in the Kannambadi Reservoir during the north-east monsoon shall be regulated in accordance with standard table I-(*b*), provided the discharges at Kannambadi exceeds (·3 × 22,750 cusecs) = 6,825 cusecs.

IV. The whole flow of the river at Kannambadi may be impounded in the reservoir from the 1st of February to the 31st of May, both dates inclusive, but issues from the reservoir must be made when necessary to maintain such a flow as will pass to Madras not less than 900 cusecs below Sivasamudram Anicut.

Computation of water to be passed from Kannambadi Reservoir to Madras from June 1st to January 31st.

V. (i) The standard gauges at the gauging places on the three rivers above the reservoir and the gauging place below the reservoir shall be read at least twice a day at 6 A.M. and 6 P.M., but when the inflow to Kannambadi exceeds 1,000 millions cubic feet per diem, the controlling officer shall instruct the gauge readers to read gauges at intervals of at least every three hours.

(ii) All gauge-readings shall be telephoned immediately after reading to the control house and entered in the registers.

VI. (i) The computation of the inflow into the Kannambadi Reservoir shall be made by the controlling officer from the electric integrating discharge records of the three rivers above the reservoir.

(ii) In the event of an electric recorder differing from the telephoned gauge-readings, the controlling officer shall, as soon as possible, proceed to the gauging place and check the electric recorder against the sixteen days automatic recorder and, in the event of the electric recorder being found in error, make a correction in the recorded inflow in accordance with the record of the sixteen days recorder.

(iii) In the event of both recorders breaking down, the telephoned gauge-readings shall be the basis of computation.

VII. The quantity of water to be passed to Madras shall be computed every twelve hours from the records of inflow of the previous twelve hours and the record of gauge-readings at the Cauvery Dam of the previous four days in accordance with rules I to III above, as long as the

inflow to Kannambadi Reservoir has not exceeded 500 millions cubic feet in the previous twelve hours, but during such time as the inflow exceeds this amount computation shall be made every six hours from the records of inflow of the previous six hours and of discharges of the previous four days at the Cauvery Dam.

VIII. (i) The quantities of water to be passed through sluices and regulation orders for the sluice shutters shall be computed by the application of the formula $D = C\ A\ \sqrt{2gh}$.

(ii) Suitable formula for the waste weir discharge will also be applied when details are known.

IX. The quantities of water actually being passed down will be verified from a gauging station, with a self-recording level and discharge recording instrument which will be installed between the dam and the Chick Devaroy Sagar Anicut. The discharges over this anicut which are deduced from gauge-readings may also be used as a check of this quantity.

Hot weather computations of issues from Kannambadi Reservoir.

X. From the 1st February to the 31st May, both dates inclusive, the controlling officer shall receive information from Sivasamudram at least twice daily of the flow during the previous twelve hours at Sivasamudram Anicut and shall by occasional visits verify the same.

XI. The amount to be issued from the reservoir shall be such quantity as will ensure the passing at Sivasamudram Anicut of the quantity provided for in rule IV.

Regulation, Calculation and Order Register.

XII. All regulation, calculations and computations provided for by any of the previous rules, to be recorded in a register called the "Regulation Register" and the orders for regulation which result from the computations to be also recorded under the signature of the controlling officer.

Regulation.

XIII. Regulation of sluices shall be made at the same intervals and immediately after the computations provided for in rule VII have been made.

XIV. (i) The regulation of sluices when at 12 hours intervals shall be made between 6 A.M. and 7 A.M., and between 6 P.M. and 7 P.M., but when at six hours intervals as provided for in rule VII shall be made between 6 A.M. and 7 A.M, noon and 1 P.M., 6 P.M. and 7 P.M. and midnight and 1 A.M.

(ii) The controlling officer shall personally satisfy himself when the sluices are finally adjusted that the regulation has been accurately carried out in accordance with recorded orders and certify that he has done so in the "Regulation Register." Under extraordinary circumstances only shall sluices be manipulated other than at twelve or six hours intervals and in such case full information regarding the reasons and necessity for this and the nature of the intermediate regulation should be communicated by the controlling officer to each Government.

XV. (i) Any minor variations, deficits or excesses in quantities due to Madras indicated by the self-recording instruments referred to in rule IX to be adjusted in the next period of regulation.

(ii) If the information provided for in rule X shows that the quantity of water due to Madras under rule IV is in defect, the regulation shall be at once altered to ensure the passing at Sivasamudram Anicut of the amount by which the flow has been deficient in the previous twelve hours *plus* the 900 cusecs provided for in rule IV and such special regulation shall be entered in the "Regulation Register" referred to in rule XII.

Discharge at Cauvery Dam.

XVI. The exact formula for determining the discharge through the Upper Anicut should be specified.

XVII. All regulation operations at the Upper Anicut and data for calculating the discharges through the Upper Anicut sluices and also all gauge-readings at the Cauvery Dam shall be recorded daily in a register under the signature of a responsible officer.

(iii) INSPECTION OF RECORDS BY EITHER GOVERNMENT.

XVIII. The controlling officer at Kannambadi shall give every facility for inspection of his registers, books, calculations, records of regulation, and actual methods of regulation and gauge-readings and discharge measurements or for tests of instruments in his charge to any officer of Madras Government appointed and authorized by that Government to make inquiry and inspection on their behalf. The controlling officer and duly accredited inspecting officers shall have full use of telephones, telegraphs, or other means of communication installed in connection with the works.

XIX. The officer at Cauvery Dam shall give the same facilities for inspection or tests as those provided for in rule XVIII to any officer of the Mysore Government appointed and authorised by that Government to make inquiry and inspection on their behalf.

(iv) INFORMATION TO BE FURNISHED BY THE CONTROLLING OFFICER AT KANNAMBADI TO EACH GOVERNMENT.

XX. The controlling officer shall make the following returns to each Government:—

(*a*) By mail daily a copy of the entries made each day on the "Regulation Register" referred to in rules XII and XIV (ii).

(*b*) By telegram daily, or at such intervals as may be agreed on, the amount of inflow into and issue from the reservoir during the previous 24 hours or during such intervals as may be agreed upon.

(v) INFORMATION TO BE FURNISHED BY THE MADRAS GOVERNMENT TO THE MYSORE GOVERNMENT.

XXI. From May 27th to 30th September both dates inclusive.

(i) A copy of the entries made each day in the register referred to in rule XVII shall be mailed daily to the controlling officer at Kannambadi by the Superintendent in charge of the Upper Anicut.

(ii) When the flow over Cauvery Dam *plus* any discharge through the vents of the Upper Anicut rises above 18,850 cusecs or falls below that amount, intimation by express telegram shall at once be given to the controlling officer at Kannambadi by the Superintendent in charge of the Upper Anicut and the time of receipt of the telegram by the latter officer shall be that for any change of regulation provided for in rule II.

Diagrams of self-recording instruments.

XXII. Photo copies of all diagrams of the self-recording instruments maintained by each Government shall be forwarded to the other Government at regular intervals.

(vi) RULES OF REGULATION ON MATTER WHICH WAS TREATED BY BOTH PARTIES AS CONTENTIOUS.

XXIII. The area to which Mysore are entitled to extend irrigation whether by extension of existing channels or by new channels above the reservoir in lieu of the existing irrigation in the area to be submerged

shall be limited to 10,200 acres. Any increase of supply for extension of irrigation over and above this area in any tract of country not hitherto commanded by existing Mysore canals or any increase in supply to existing channels effected either by alteration of anicut levels or by the enlargement of existing or the construction of new head sluices, shall be provided for by a re-adjustment of the standard tables—the quantities of water to be impounded under the standard tables shall be reduced by the amount of such increased supplies in the case of channels above the reservoir and the issues due to Madras under the standard tables shall be increased by the amount of such increased supplies in the case of channels below the reservoir.

XXIV. But any increase in area of irrigation on existing canals within the tracts already commanded by them which extensions do not require larger supplies than have hitherto been run in the existing channels shall be regarded as natural development of irrigation in respect of which no re-adjustment of the quantities of water due under the award shall be made.

XXV. Whether or not any such extension of irrigation shall or shall not count as requiring re-adjustment of the quantity of water to be impounded at or passed on from Kannambadi under the award shall, in the case of dispute between the parties, be referred for the final decision of the Government of India.

Award on Term of Reference 3 (*a*)—*contd.*

The award delivered on the 29th April dealt with the general principles or systems under which the Kannabadi Reservoir could be operated so as to ensure the passing down to Madras of the supplies to which Madras are entitled.

The actual rules for the working of the reservoir have now to be considered.

On many points, generally speaking of a technical nature, both parties are in agreement.

The points on which the parties differ are set out in the Assessor's Examination of the Evidence and I proceed to give my opinion thereon—

(*1*) *The Madras proposal that the controlling officer and staff for the regulation of the reservoir shall be independent of both parties and appointed by the Government of India.*

This proposal proved unacceptable to Mysore. I do not suppose that the Mysore Government contemplated, in making this reference to arbitration, to invest the Arbitrator with the power to deprive them of the control of their reservoir by transferring it to officials independent of Mysore. I doubt whether under the terms of reference I have the judisdiction to make any such Award as is asked for by Madras on this point. Apart from this doubt, there appears to me no reason to believe that Mysore will not loyally carry out whatever decision may be arrived at. There is also no reason to entertain any doubts as to the efficiency of Mysore administration. It is to be presumed that Mysore realise the gravity of the situation which would arise by reason of any failure on their part to fulfil their obligations. Agreeing with the Assessor, I am of opinion that the Madras proposal cannot be entertained.

(*2*) *The suggestion of Mysore that they should be given the advantage of impounding irrespective of the limits of the Award on occasions when rainfall in the delta may reduce the demand on the canal supplies.*

This suggestion was an inherent item of the Mysore system which system has been considered in the Award on the first part of this term of reference and I agree with the Assessor that it is impracticable to give effect to the Mysore proposals on this point.

In the same manner Mysore have, after the delivery of the Award, on two occasions put forward representations on the question of the hot weather supply, the Award on which they considered unfavourable. The parties must realise that there must be some finality in these proceedings. It is sheer waste of time to persist in reiterating pleas and statements which have been fully considered already and disposed of.

(*3*) *The question as to whether any allowance is to be made in the reservoir issues under the Award to adjust quantities of water required for any extension or changes in character of irrigation in Mysore channels taking off either above or below the reservoir.*

Any extension of irrigation (over and above an area equivalent to the existing irrigation in the area submerged by the reservoir) which is made possible by and is ascribable to the reservoir, entails a diminution of the inflow into the reservoir in the case of channels above the reservoir and a diminution of the part of the outflow passed to Madras in the case of channels below the reservoir. In either case such extra withdrawals are matters affecting Madras interests under the Mysore project.

In respect to the area to be irrigated above the reservoir in lieu of existing irrigation on the submerged area, I accept the Assessor's estimate of 10,200 acres as fair.

I am of opinion that rules on the lines indicated in paragraphs 8 and 9 of the Assessor's Examination of the Evidence are necessary in order to meet this contingency and to provide for the other contingencies dealt with by the Assessor and these have been incorporated in the schedule of rules set out below.

On the question (which, though strictly speaking it does not arise under this term of reference, may be dealt with here) as to the extent of information regarding the Mysore project which Madras are entitled to receive, I may say that looking to the terms of the Agreement of 1892 Madras are entitled to such information as enable them to form a judgment as to how the Mysore project will affect their prescriptive rights. Madras are vitally interested in the stability of the proposed reservoir and in the engineering details which would ensure the full conservation of Madras rights. The Mysore project (My. 5) does not contain this information in full detail so that strictly speaking Madras would have been within their rights if they had confined their refusal to sanction the project to this ground alone.

I agree with the Assessor that Madras are fully entitled to the information set out in paragraph 10 of the Assessor's Examination of the Evidence and it is incumbent on Mysore to supply such information without unnecessary delay.

My Award on this part of term of reference 3 (*a*) is embodied in the following rules:—

RULES OF REGULATION.

(i) Preamble.

The carrying out of the following rules of regulation shall, in so far as they relate to the regulation of Kannambadi Reservoir, be the duty of a controlling officer and of a subordinate staff working under his orders.

2. The only discretion to be exercised by the controlling officer in operating the Rules of Regulation shall be as to the means by which the water to be passed from the reservoir to the river shall be passed and such discretion shall be exercised in general accordance with the instructions of the Mysore Government.

3. The rules, with the exception of Nos. I to IV inclusive, shall be subject to amendment as may be found desirable, subject to the conditions below:—

   (*a*) The rules may be altered tentatively for one or two years by agreement of both parties or, in default of agreement, under the decision of the Government of India, after hearing both parties.

   (*b*) At the end of the tentative period the amended rules may be confirmed either by the consent of both parties or, if only one party desires confirmation, under the orders of the Government of India, after hearing both parties.

   (*c*) Subject to conditions (*a*) and (*b*) above, amendment of any rule shall not be a bar to further amendment or reversion to the original rules by consent of both parties or, if new facts are adduced, under the orders of the Government of India, after hearing both parties.

4. The tentative proportion factors in Rules II and III and the tentative percentage losses in transmission from Kannambadi to the Cauvery Dam of 20 per cent in the south-west monsoon and 17 per cent in the north-east monsoon shall be in force for four years from now and shall be reviewed by the Government of India at the end of that period after hearing both parties and, if found practicable by that Government, final factors and percentages shall then be fixed. The factors and percentages finally fixed by the Government of India shall not be subject to revision.

5. The curves of discharge of all gauging places in Mysore State and of the Cauvery Dam should be verified at intervals of two or three years.

6. All formulæ and co-efficients in such formulæ of discharge referred to in the rules should be verified at intervals of two or three years.

7. If the verification of curves of discharge or formulæ referred to in clauses 5 and 6 above show that revision of the curves or formulæ or co-efficients in the formulæ is necessary, such revision shall be made subject to the conditions specified in clause 3 above.

8. All quantities and readings of gauges to be telegraphed in accordance with the rules, shall be expressed in words.

(ii) RULES OF REGULATION.

I. The south-west monsoon shall, for the purpose of these rules, be considered to extend from the 1st June to the 30th September, both dates inclusive, and the north-east monsoon from the 1st October to the 31st January, both dates inclusive.

Impounding.

II. Impounding in the Kannambadi Reservoir during the south-west monsoon shall be regulated in accordance with standard tables I-(a) and II in the following manner:—

(i) Impounding under standard table I-(a) shall commence as soon as the flow at Kannambadi exceeds (·625 × 22,750 cusecs) = 14,219 cusecs, provided that the flow over the Cauvery Dam *plus* any discharge through the vents of the Upper Anicut had exceeded 18,850 cusecs at any time during the proceeding four days.

(ii) If the discharge of 18,850 cusecs referred to in clause (i) of this rule had not been exceeded at any time during the preceding four days, then impounding shall commence under standard table II.

(iii) If, during the period of operation of standard table I-(a), the discharge of 18,850 cusecs referred to in clause (i) of this rule, had not been exceeded at any time during the preceding four days, then impounding shall proceed under standard table II.

(iv) If, during the period of operation of standard table II, as provided for in clauses (ii) and (iii) of this rule, the flow at Kannambadi reaches 15,277 cusecs, then twelve hours after the inflow had reached this stage impounding shall proceed under standard table I-(a), provided that the discharge of 18,850 cusecs referred to in clause (i) of this rule had been exceeded at any time during the preceding four days.

III. Impounding in the Kannambadi Reservoir during the north-east monsoon shall be regulated in accordance with standard table I-(b), provided the discharge at Kannambadi exceeds (·3 × 22,750 cusecs) = 6,825 cusecs.

IV. The whole flow of the river at Kannambadi may be impounded in the reservoir from the 1st of February to the 31st of May, both dates inclusive, but issues from the reservoir must be made when necessary to maintain such a flow as will pass to Madras not less than 900 cusecs below Sivasamudram Anicut.

Computation of water to be passed from Kannambadi Reservoir to Madras from June 1st to January 31st.

V. (i) The standard gauges at the gauging places on the three rivers above the reservoir and the gauging place below the reservoir shall be read at least twice a day at 6 A.M. and 6 P.M., but when the inflow to Kannambadi exceeds 1,000 millions cubic feet per diem, the controlling officer shall instruct the gauge readers to read gauges at intervals of at least every three hours.

(ii) All gauge-readings shall be telephoned immediately after reading to the control house and entered in the registers.

VI. (i) The computation of the inflow into the Kannambadi Reservoir shall be made by the controlling officer from the electric integrating discharge records of the three rivers above the reservoir.

(ii) In the event of an electric recorder differing from the telephoned gauge-readings, the controlling officer shall, as soon as possible, proceed to the gauging place and check the electric recorder against the sixteen days automatic recorder and, in the event of the electric recorder being found in error, make a correction in the recorded inflow in accordance with the record of the sixteen days recorder.

(iii) In the event of both recorders breaking down, the telephoned gauge readings shall be the basis of computation.

VII. The quantity of water to be passed to Madras shall be computed every twelve hours from the records of inflow of the previous twelve hours and the record of gauge readings at the Cauvery Dam of the previous four days in accordance with rules I to III above, as long as the inflow to Kannambadi Reservoir has not exceeded 500 millions cubic feet in the previous twelve hours, but during such time as the inflow exceeds this amount computation shall be made every six hours from the records of inflow of the previous six hours and of discharges of the previous four days at the Cauvery Dam.

VIII. (i) The quantities of water to be passed through sluices and regulation orders for the sluice shutters shall be computed by the application of the formula $D = C A\sqrt{2gh}$.

(ii) Suitable formula for the waste weir discharge will also be applied when details are known.

IX. The quantities of water actually being passed down will be verified from a gauging station, with a self-recording level and discharge recording instrument which will be installed between the dam and the Chick Devaroy Sagar Anicut. The discharges over this anicut which are deduced from gauge readings may also be used as a check of this quantity.

Hot weather computations of issues from Kannambadi Reservoir.

X. From the 1st February to the 31st May, both dates inclusive, the controlling officer shall receive information from Sivasamudram at least twice daily of the flow during the previous twelve hours at Sivasamudram Anicut and shall by occasional visits verify the same.

XI. The amount to be issued from the reservoir shall be such quantity as will ensure the passing at Sivasamudram Anicut of the quantity provided for in rule IV.

Regulation, Calculation and Order Register.

XII. All regulation, calculations and computations provided for by any of the previous rules, to be recorded in a register called the "Regulation Register" and the orders for regulation which result from the computations to be also recorded under the signature of the controlling officer.

Regulation.

XIII. Regulation of sluices shall be made at the same intervals and immediately after the computations provided for in rule VII have been made.

XIV. (i) The regulation of sluices when at 12 hours intervals shall be made between 6 A.M. and 7 A.M., and between 6 P.M. and 7 P.M., but when at six hours intervals as provided for in rule VII shall be made between 6 A.M. and 7 A.M., noon and 1 P.M., 6 P.M. and 7 P.M. and midnight and 1 A.M.

(ii) The controlling officer shall personally satisfy himself when the sluices are finally adjusted that the regulation has been accurately carried out in accordance with recorded orders and certify that he has done so in the "Regulation Register." Under extraordinary circumstances only shall sluices be manipulated other than at twelve or six hours intervals and in such case full information regarding the reasons and necessity for this and the nature of the intermediate regulation should be communicated by the controlling officer to each Government.

XV. (i) Any minor variations, deficits or excesses in quantities due to Madras indicated by the self-recording instruments referred to in rule IX to be adjusted in the next period of regulation.

(ii) If the information provided for in rule X shows that the quantity of water due to Madras under rule IV is in defect, the regulation shall be at once altered to ensure the passing at Sivasamudram Anicut of the amount by which the flow has been deficient in the previous twelve hours *plus* the 900 cusecs provided for in rule IV and such special regulation shall be entered in the "Regulation Register" referred to in rule XII.

Discharge at Cauvery Dam.

XVI. The exact formula for determining the discharge through the Upper Anicut should be specified,

XVII. All regulation operations at the Upper Anicut and data for calculating the discharges through the Upper Anicut sluices and also all gauge-readings at the Cauvery Dam shall be recorded daily in a register under the signature of a responsible officer,

(iii) INSPECTION OF RECORDS BY EITHER GOVERNMENT.

XVIII. The controlling officer at Kannambadi shall give every facility for inspection of his registers, books, calculations, records of regulation, and actual methods of regulation and gauge readings and discharge measurements or for tests of instruments in his charge to any officer of Madras Government appointed and authorized by that Government to make inquiry and inspection on their behalf. The controlling officer and duly accredited inspecting officers shall have full use of telephones, telegraphs or other means of communication installed in connection with the works.

XIX. The officer at Cauvery Dam shall give the same facilities for inspection or tests as those provided for in rule XVIII to any officer of the Mysore Government appointed and authorised by that Government to make inquiry and inspection on their behalf.

(iv) INFORMATION TO BE FURNISHED BY THE CONTROLLING OFFICER AT KANNAMBADI TO EACH GOVERNMENT.

XX. The controlling officer shall make the following returns to each Government:—

(*a*) By mail daily a copy of the entries made each day on the "Regulation Register" referred to in rules XII and XIV (ii).

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XXIV. But any increase in area of irrigation on existing canals within the tracts already commanded by them which extensions do not require larger supplies than have hitherto been run in the existing channels shall be regarded as natural development of irrigation in respect of which no re-adjustment of the quantities of water due under the award shall be made.

XXV. Whether or not any such extension of irrigation shall or shall not count as requiring re-adjustment of the quantity of water to be impounded at or passed on from Kannambadi under the Award shall, in the case of dispute between the parties, be referred for the final decision of the Government of India.

Arbitrator's Award on Term of Reference 3 (b).

" 3. (*b*) Whether the rules at first formulated should not be tentative, and, if so, for what period and to what extent? "

The parties are in agreement that the rules framed should be tentative and subject to revision at any time by consent of parties. In case of disagreement, the question is to be decided on a reference to the Government of India.

With regard to the re-adjustment of the tentative proportions adopted in the Award under 3 (*a*), both parties are in agreement that the question shall be taken up after a period of four flood seasons, say, about November 1917, when the data to be collected for the purpose under the rules will be reviewed by an officer appointed for the purpose by the Government of India.

I award as above.

Arbitrator's Award on Term of Reference (4).

"(4) Will the construction and working of the Kannambadi Reservoir necessarily prevent the passing on to Madras of the quantity of water due to Madras?"

Madras strongly contend that the question of the success or failure of the Mysore project is one which they are entitled to enter into under this term of reference. As the Madras Representative stated that he understood that he was entitled to raise this aspect of the case under this term of reference, I permitted the parties to put in their statements on the point.

I may here state that, on a full consideration of the 1892 Agreement and of the negotiations which led up to it, I am of opinion that the question of the success or failure of a Mysore project as a commercial undertaking, is not a matter with which Madras has any legitimate concern. If it were possible to conceive a Mysore project, wholly impractical, with no prospect of success, and which could only constitute a standing menace to Madras interests, it might well be held that Madras would be entitled to a right of veto. But this is not the case here, as the information laid before us on the question amply demonstrates. The information which has been put in in this connection will be found useful if the case is referred to the Government of India by either party for confirmation or modification of the Award. The Assessor has shown that the parties on identical data have arrived at diametrically opposite conclusions. The arguments have been fully considered by the Assessor and I agree with his reasons and conclusions. On the question of the prospects of the Mysore project I must be guided by his opinion. Out of the thirteen years for which working tables have been prepared, the reservoir would have been fully successful in six years and according to Madras there would have been minor failures in four years, a medium failure in one year and a major failure in two years. The Assessor's opinion is that he should classify the years represented by Madras as minor or medium failures as indicating from very good to reasonably successful operation of the reservoir.

I must hold therefore that an examination of the evidence does not support the contention of Madras based on the precariousness of the Mysore project.

In the course of the proceedings at the final stage of the case, Mysore in My. 28 (16) expressed their readiness to modify their project by increasing the capacity of the reservoir if it is found to be desirable or necessary to do so.

This suggestion has been dealt with by the Assessor

The question submitted to arbitration is whether or not the Mysore project for the construction of a reservoir of a net capacity of 37,000 millions cubic feet should be sanctioned and any expression of opinion on the question of the construction of a larger reservoir would be beyond my jurisdiction.

In conclusion, I regret that it has been impossible to arrive at a settlement satisfactory to both parties. Each party set out claims which on examination were found inadmissible in whole or in part.

The claims of Madras, if allowed, would probably have resulted in making the Mysore project impossible; those of Mysore, in seriously impairing the interests of Madras. Throughout the proceedings there has been a regrettable lack of the spirit of compromise. The solution we have arrived at recognises the paramount importance of the existing Madras interests, has for its primary object the safeguarding of those interests and does, we believe, safeguard them effectually. At the same time it gives to Mysore the opportunity of utilizing for their own benefit their fair share of the surplus waters of the Cauvery.

Subject therefore to the due observance of the award, I am of opinion that the construction and working of the Kannambadi Reservoir will not necessarily interfere with the prescriptive rights of Madras and I award accordingly.

On the broad question involved in this appeal to the arbitration, I am of opinion that, subject as above to the due observance of the award and to the supply by Mysore of the information required as to stability, etc. (*vide supra*) of the reservoir, sanction should be accorded to the Mysore project.

H. D. GRIFFIN,
Arbitrator.

12*th May* 1914.